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Combustion Control

BOILER-firing control has received too little consideration by supply engineers, notwithstanding the fact that it is common to the much talked of questions of pulverised-fuel *versus* stoker firing, high- or low-pressure and temperature steaming, and good- or poor-quality coal. The subject has been brought to the fore by the latest development in this country, the adoption of automatic control at the new Kirkstall power station of the Leeds Corporation electricity undertaking, a description of which we publish in following pages of this issue.

The boiler house plays by far the most important part in the fight for the two outstanding requirements of electricity generation efficiency and flexibility of operation. There are two definite and opposing trends with regard to plant layout to secure high efficiency; that leaning towards the simple boiler-engine-condenser scheme, and that favouring all manner of auxiliaries, the object of some of which appears to be to beat the Carnot cycle by extending the use of the latent heat of the steam.

Uniformity of control is the keynote of success with regard to boiler management, and the question arises: which will afford the greater degree of uniformity, simplification or complication? Certainly with hand control the simpler the plant the better for actual operation, while complication may be the justification of the automatic method. Deduction brings us to the simple issue—to what extent can the complexity of the apparatus be increased and very wide load fluctuations be met before the human element loses the grip.

Without entering into the *pros* and *cons* of simplification *versus* complication, we feel that automatic control is not justifiable under present load conditions; but possible load fluctuations of the order of 100,000 kW under the grid operation are being talked of. Are we to expect breakdowns daily, or do the exponents visualise a dominating traction load? Undoubtedly power-station loading conditions are to be changed, and probably before many years our ideas of base and peak loads will have to be remodelled.

Advocates of automatic combustion control have emphasised the claims for advantages in connection with pulverised-fuel firing in meeting exigencies pertaining to the use of low-grade fuel, indeed we believe that the method was first established for working with p.f. firing; at the new Leeds station, however, coal of high calorific value is used, and the care taken in the laboratory must result in the risk of non-uniform fuel conditions being far less than that in most stations in this country.

Automatic control has a bearing also on the question of supply continuity. As with everything else, electricity supply can be safeguarded absolutely (within the sphere of human control in its broadest sense)—at a cost. To what extent is playing for safety justified?

Another aspect of the subject is the cost of labour. Large modern boiler houses with hand control are nowadays managed by one man; can the labour requirements

of the " automatic " plant be reduced lower than this? We think not. Further, would a specially skilled class of labour be required for control equipment adjustment?

There is one particularly favourable point about automatic boiler control, at any rate the system employed at Kirkstall, the control equipment proper is simple and thus has a high reliability factor.

Whether or not automatic governing proves to be the right method for future conditions, one fact must not be overlooked—the courageous move at Leeds and other places has immense research value to the supply industry as a whole.

Fifty Years!

ARE we as ready to do honour to the architects and builders of big electrical industries as we are to acknowledge the great debt that we owe to our eminent scientists and inventors? Science is no longer the Cinderella—she is wedded to Prince Industry! Nowadays everybody recognises that the two must go hand in hand. There was a time when the financial reward of the inventor was poor, and, discovering the error, we placed him upon a pinnacle of fame for admiration by posterity. In meting out our rewards, however, are we doing full justice to the founders and controllers of our great industries? How many of our readers can name off-hand a dozen of the outstanding men who, say, fifty years ago were laying the foundations of great businesses which, dovetailing together, now form a large part of that magnificent whole which we term the electrical industry? Millions of money yielding profitable returns to shareholders have been invested; hundreds of thousands of men have found electrical employment; a great trade is being done; and British reputation for our products stands high. Some pioneers have made fortunes—others have lost them. They need no monuments of stone—these men—the great electrical factories stand out boldly. Some of the men of electrical industrial fame are with us still and we do well to salute them. To one of them, this twenty-seventh day of March, 1931, brings both wistful retrospection and much gratification for, as we state in our " Personal " page, exactly fifty years have passed since George Sutton began his ever-progressive connection with Henley's—the business set afoot by William Thomas Henley—of which he is now the honoured chairman. To you, Sir George Sutton, Bart., we tender our own and the industry's heartiest congratulations!

The Whirligig of Time

SIR WILLIAM BRAGG told us at the E.D.A. luncheon last Friday that the Royal Institution was once a publicity organisation. Next autumn it will revert for the nonce to its original character by taking the lead, supported by the Institution of Electrical Engineers and other scientific bodies, in demonstrating the unique historical significance of the discoveries of Michael Faraday. The invitation to students to act as public guides at the Albert Hall Exhibition will be a privilege indeed to the youth of this generation and the work of fitting themselves for the task will be for them a liberal education. They will do well to take as their guiding idea that Faraday was a great exponent of simplicity in explanation as well as in experiment. The Faraday celebrations should go far to remove what Sir William referred to as our " inferiority complex " —probably in its varying manifestations the most inhibiting influence in the world.

Money Must be Found

THE annual report of the E.D.A. Council, which is reviewed in this issue, shows that the Association's revenue rose last year by about 19 per cent. This was due not only to the enrolment of new members, among which we are glad to see the Glasgow Corporation, but also to the decision of several other undertakings, already members, to subscribe the full amount on the recognised scale. The Association's thanks are also due to the E.C.A. for a special contribution of £1,025 to the funds. But who can feel satisfied with a total of £37,000, which seems a pitifully small amount for the powerful group of electrical industries to pay for the invaluable services which E.D.A. provides? The report shows how wide and varied the Association's activities are. Unless these activities are supported and strengthened in every direction they must represent a mere dissipation of energy. By means of the area sub-committee and circle system, E.D.A. has gathered together and organised a great body of enthusiastic workers in the cause of development. These men and women devote considerable time to this work, but their efforts could be made far more effective if more adequate funds enabled the Association to back them up by arranging attractive demonstrations on a suitable scale, by more insistent advertising, and by the many other means which money would render possible. Sympathy and approval are not enough; hard cash is called for if E.D.A. is to be a power in the land.

The Norwich Scheme

IN the description of the Norwich rural electrification scheme issued by the Electricity Commissioners at the end of last week, we notice that, while substantial allowances have been made for canvassing and advertising in the first five years, no such provision is included in the estimates of subsequent years. We gather that the expenses of management are then considered to cover development work, but we are not told whether such expenses will be correspondingly increased. There should be no difficulty in selling electricity for lighting, while as a result of energetic propaganda a cooking load and a certain amount of water heating and intermittent heating will follow, especially as there is no gas available. The 500 kWh per consumer expected in the sixth year is not sufficiently in advance of the 432 kWh now obtained from the average rural *domestic* consumer to warrant reducing development expenditure. To secure the residual load, after the satisfaction of the more obvious demands, will require skill of a high and specialised character. Not less but more money should then be allocated to development work, even if it necessitates the postponement of the time when profits can be earned.

Modern Lighting

SEVERAL recent lectures and papers on the trends of modern practice in artificial illumination have contained much solid food for thought that should repay careful assimilation. The popular idea that modern lamps are highly efficient light-producing devices is unfortunately quite erroneous; notwithstanding wonderful development, they are, at best, capable of but a fraction of the theoretically possible; and the jubilee of the incandescent filament lamp has heralded the advent of a serious rival in the form of the luminous gas-discharge tube. Apart from efficiency, the latter is undoubtedly destined to play a very important part, perhaps sooner than is generally realised, even in the domestic sphere, and the consequent removal of the source-shape restriction will materially influence the design of fittings; indeed, such a tendency has already become evident. Illumination rightfully claims its place among the useful arts and the designer of lighting systems must be as much an artist as an engineer, aiming to achieve his utilitarian purpose in a pleasing way, and, as Dr. J. W. T. Walsh remarked in a lecture which is briefly reported elsewhere in this issue, the above-mentioned tendency should aid him to do so. It is sometimes argued that the pendulum of fashion has swung so far from the hitherto guiding principal of functionalism as seriously to limit utility in the effort to produce artistic effects, but it must be remembered that the design of fittings has been given an entirely new orientation, and so it is not surprising that the bewilderingly wide range at present available has led to mistakes at times and unexpectedly disappointing results. Meanwhile, until the art has established itself, all that can be done is the promotion of the study of some of the examples which are generally acknowledged to be successful in an endeavour to deduce from them some guiding principles. That seems to be the most urgent duty of the lighting engineer of to-day.

KIRKSTALL

The New Leeds Power Station

Pulverised-fuel firing, long-distance conveyance of powdered coal, and automatic boiler control render the new power station of the Leeds Corporation of outstanding interest.

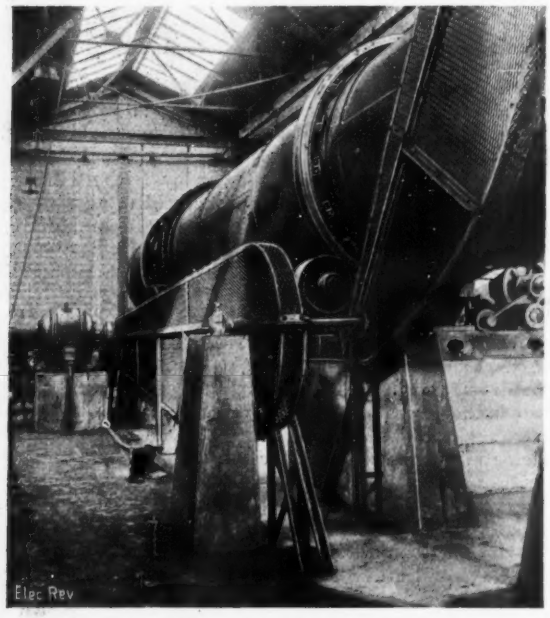
THE new Kirkstall power station of the Leeds Corporation electricity undertaking has now been running under light-load conditions for about four months, and the results so far, although they are not representative of the normal station working, suggest that the confidence of the general manager and city electrical engineer, Mr. C. Nelson Hefford, M.Sc., M.I.E.E., who made somewhat drastic departures from usual practice when designing the station, will be fully rewarded. The station has been laid out for an ultimate plant capacity of 150,000 kW, the limit for the initial section being 50,000 kW. It is to be a base-load station working in conjunction with the grid, so that it is not likely to be fully developed until the grid is in operation. A sub-station of the Central Electricity Board is being built adjacent to the works site, and it appears to be near completion. The average weekly coal consumption up to the present has been 1.55 lb. per kWh, using coal of about 12,150 B.th.u. per lb. calorific value, resulting in a thermal efficiency of about 20 per cent., with a very poor load factor. During February the maximum load on the station was 16,000 kW, and the kWh generated totalled 3,498,700. There is at present a load couple of something like 10,000 kW between the two Leeds stations at Kirkstall and Whitehall Road.

The site covers some 104 acres, and is situated between the Leeds and Liverpool Canal and the River Aire, roughly on a line from Armley to Kirkstall, and adjacent to the L.M. & S. Railway, sidings from which are taken to the boiler house and the turbine room. It will be seen from the lay-out plan that the railway prevents the main building being close to the canal or coal-receiving point, with the result that the coal, after milling and drying, is conveyed some 1,000 ft.; this is believed to be the longest transportation of dry pulverised fuel in this country. The main building has a pleasing appearance, being of red brick ornamented with terra cotta facings and copings. It embraces the boiler and turbine houses, control and switch rooms, and also a block of administration offices, stores, laboratory, &c. Adequate natural lighting is provided at every part.

The canal serves as the transit medium for the coal, a special branch providing the necessary berthing and unloading facilities, and the condenser water is taken from the river. Two telphers and tracks, each of 40 tons per hour capacity, receive the coal from 60-ton barges and discharge it through an automatic weighing machine into a 300-ton storage bunker, the weigher and bunker being incorporated in the telpher-plant structure at the end of the tracks. Two separate belt-conveyor systems carry the coal either to bunkers at the top of the coal-preparation house or to the storage ground. A 10-h.p. dust- and weather-tight motor installed in the open drives the storage-ground conveyor. The other conveyor is served by a 5-h.p. motor at the elevated end. The telpher plant was installed by Isles, Ltd., the conveyors by the Underfeed Stoker Co., Ltd., and the weigher by Richard Simon and Sons, Ltd. There are three inclined rotary dryers, each served by a 70-ton bunker overhead and driven by a 70-h.p. motor. The flue gases from a small hand-fired furnace, one for each dryer, are carried through the inner cylinder of the dryer and back through the annular space between the cylinders, containing the moving fuel, and exhausted under the influence of an induced-draught fan. The coal from the dryers is passed into screw conveyors, picked up by two bucket elevators and delivered into dry raw-coal mill bunkers, one over each of three mills. A 10-h.p. motor serves the screw conveyor, and a 7.5-h.p. motor drives each bucket conveyor. The conveyor and elevators were supplied through International Combustion Co., Ltd. From each dry raw-coal bunker the coal falls by gravity on to an automatic rotary feeder and into a 15-ton Raymond mill. Each mill is driven by a 200-h.p. motor, the mill-spider speed being from 98 to 100 r.p.m. and the roller speed 300 r.p.m. A 100-h.p. exhauster fan sends the powdered fuel from the mill to the cyclone, in which the coal not of requisite fineness is by-passed back to the mill, and a screw conveyor carries it, *via* a weir, to the p.f. bunker. Each mill is equipped with two rotary feeders of the fluted-spindle type, working through a ratchet arrangement and driven by a 1-h.p. motor, each feeder being capable of doing the whole of the work. The pulverised coal falls under gravity from the p.f. bunker into two fuel transporters which convey the fuel by screw transmission to the pump head at the end of the p.f. line. Each transporter is driven by a 75-h.p. motor, 720 r.p.m., and is capable of delivering 40 tons of fuel per hour. In conjunction with each transporter works an Alley & Maclellan compressor, 100 h.p., which delivers at 75 lb. per sq. in. to the pump head, thus blowing the powdered fuel through the pipe lines to the steam-generator bunkers. The pipe line is carried on a five-span steel bridge over the railway. For the supply to the pulverising machinery and coal-handling drives there is a brick-built sub-station at hand equipped with three 750-kW, three-phase, Hackbridge transformers and G.E.C. cellular switchgear, 6,600/346 V.

The boiler house is 95 ft. high, 76 ft. wide, and 142 ft. long. In each p.f. pipe line at the entrance to the bunkers is an electrically-operated valve controlled from the firing floor. The bottom of each bunker finishes in three suitable hoppers in the boiler-house basement, and the fuel from each falls into a fuel feeder driven by a small six-speed motor, and is driven along a short pipe-line to a junction with a similar line connected with a primary-air fan driven by a 57-h.p. motor. From the junction single pipes are arranged across the basement and vertically up the fronts of the boilers to the "Lopulco" turbulent burners, conveying the mixture of fuel and primary

air. There are three 175,000-lb. Stirling tri-drum boilers, each complete with a Foster economiser and a superheater by the Superheater Co., Ltd. The boiler steam conditions are 490 lb. per sq. in. and 750 deg. F. Excluding the basement, there are four galleries or floors arranged round the boiler walls, from the firing floor at the bottom to the drum level at the top. The induced- and forced-draught fans are arranged on the floor next to the top. The flue gases from each economiser pass through an air pre-heater to the i.d. fan and into the stack *via* a Davidson cyclone, and the f.d. fan delivers air through the air heater, working on the regenerative principle, to the primary-air fan. The economisers, boilers, and air pre-heaters are cleaned by Parry soot blowers. Other features of the boilers are automatic Hopkinson regulators and



One of the Rotary Coal Dryers

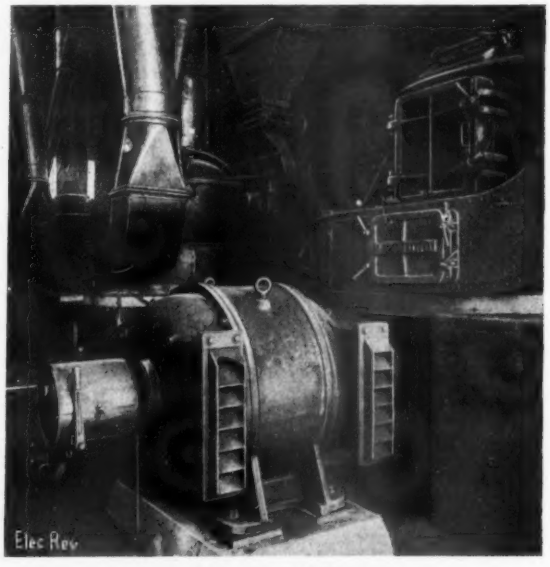
electrically-operated stop valves controlled from the firing floor.

The boilers are equipped for full- or semi-automatic, or hand operation on the Bailey system, and the required method of operation is brought about by an indicator switch on the chart panel flanking the front of each boiler. A second facing panel serves for the control of the fuel-feeder motors, and is equipped with "start" and "stop" push buttons, &c., and a resistance regulator. The "nerve centre" of the control system is at the back of a small panel facing the boiler. A small copper-tube spiral, similar to a pressure-gauge spiral, is directly connected to the steam range. As the spiral expands and contracts with the steam-pressure variations, a horizontal arm, corresponding to the instrument pointer, is moved up and down and completes the circuit between one of two pairs of contacts, according to the direction of movement. A very small motor continually moves the contacts to and fro, thus making and breaking the circuits, so that with each "make" an operation is performed, advancing or retarding one step on the motor rheostat. This apparatus can be made to operate through the necessary relays any or all of the apparatus governing the boiler working: draught fans, damper, fuel feeders, and so on. There are two i.d. fans, and as soon as full load on one motor is reached the second fan is put into operation by a connection on No. 1 rheostat. The flue damper working in conjunction with No. 1 i.d. fan is operated by hand, and that for No. 2 i.d. fan is electrically operated. There are three Bailey charts on each panel. One records steam pressure, air flow and evaporation, "synchronism" indicating 15 per cent. CO_2; water inlet and outlet and steam temperatures on the second; and the air-heater, economiser and boiler outlet gas temperatures and air-heater outlet air temperature on the third instrument.

The flue gases from each boiler unit pass through two cyclones, and the grit and dust deposits are collected in dust boxes beneath, fed in each case through a valve which operates under the weight of the deposit, so that cold air cannot get back into the cyclones.

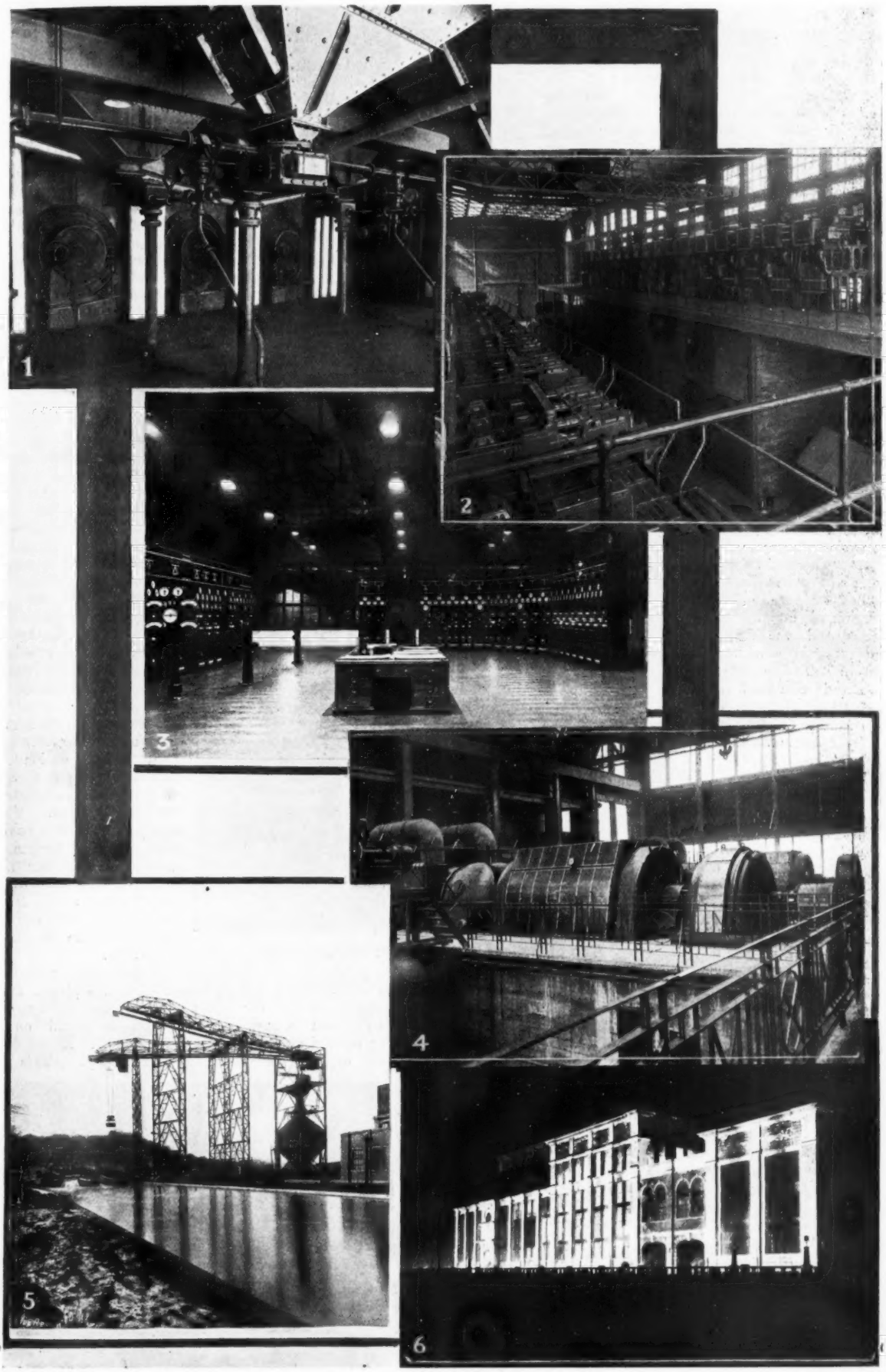
The ash and dust removal is carried out by a "Hydrojet" installation by the Ash Co., Ltd., in connection with which a vacuum exhauster driven by a 20-h.p. motor and supplied by the British Vacuum Cleaner Co., Ltd., is installed. The vacuum plant removes the dust from the boxes to a receiver outside, and when the latter is filled, water pumps are put into operation and project a stream of water through a tee connection at the back of the base of the receiver in such a manner that the dust is carried by suction with the water into a tank below. Finally, a slurry pump transports the mixture to a settling pond on the site. There are two vertical water pumps, each driven by a 75-h.p. motor. The "Hydrojet" plant also serves for the ash removal and also to clear the dust from the economisers and air preheaters. From the combustion chambers the ash falls into a chamber in which it is sprayed with water jets, and the mixture falls into a trough in which it is carried at a high velocity direct to the tank outside under the influence of duplicate 100-h.p. ash-sluice pumps installed in the condenser basement and drawing water from the main condenser discharge duct. The dust from each economiser and air preheater falls into an inclined pipe line, at the head of which is projected water in similar fashion to that for the dust receivers. The valve controls for the dust- and ash-removal installation are all conveniently located. There are two vertical steam receivers connected in the main range between the steam and electricity generating sets.

The turbine-room main plant consists of two B.T.-H. 25,000-kW turbo-alternators, 3,000 r.p.m., 50 cycles,

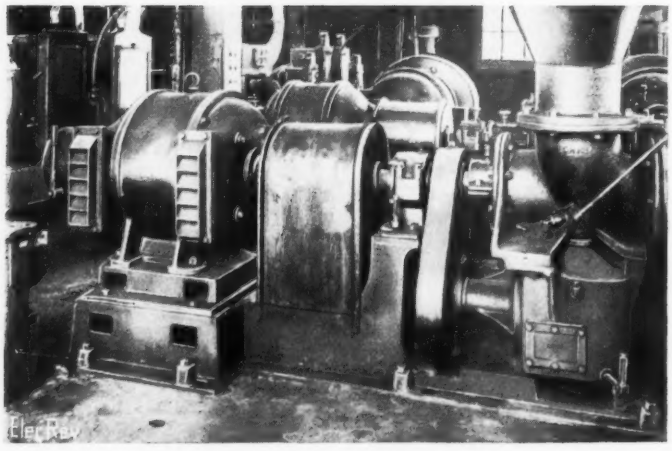


Some of the Coal Milling Gear

11,000 V. The turbines are two-cylinder machines, the h.p. cylinder being of the pure impulse type with 16 stages, and the l.p. section of the double-flow type with reaction blading. The turbine stop-valve steam conditions are 460 lb. per sq. in. and 720 deg. F. Each turbine is equipped with instruments for measuring the steam flows to the turbine, pumps and ejector, separately, "Electroflo" efficiency meter, "Dionic" water-purity meter, &c. Owing to the particularly dirty state of the River Aire, large vertical Allen surface condensers fitted with 1-in. diameter cooling tubes are employed to receive the turbine exhausts, a condenser being positioned beside each turbine. The normal working for the condenser circulating system is two-flow, but by means of electrically-operated valves



Representative views of Kirkstall Power Station. (1) Boiler front; note open burner doors and control board on right. (2) View in switch house; higher capacity equipment on lower level. (3) Control room by night. (4) Turbine room; vertical condenser on left showing electrically operated valve. (5) Coal-handling plant. (6) Exterior of main building floodlighted.

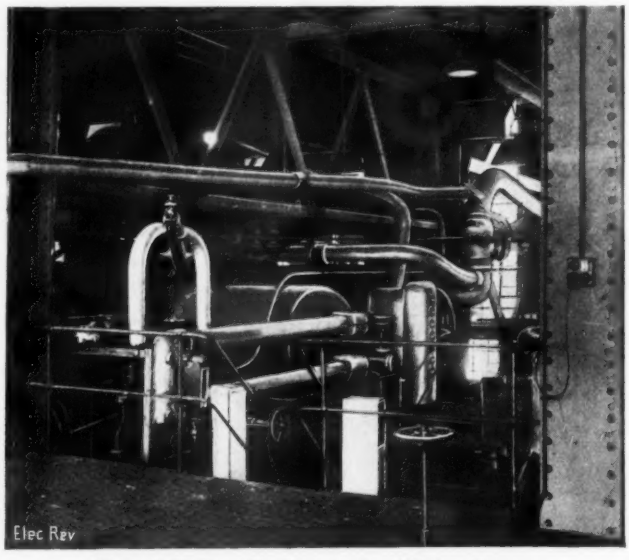


Coal Transporters: Fans at Rear

under push-button control, the system can very easily be converted to single- or reverse-flow, the latter being employed for removing the deposits at the bottom when necessary. An "Allen" air ejector and two Allen extractors, one electric and one steam, are employed for each condenser. The steam and water system is arranged on the closed-circuit principle, an Allen evaporator being arranged in the circuit and the balance adjusted by a surge tank. The make-up water is obtained from a well on the site, and the pumping is electrically operated. In the circuit are also arranged Allen heaters fed with steam "bled" from the turbines. There are three extraction points on each turbine, two only of which are at present used. Three Weir steam feed pumps operate in conjunction with each set, 5,000 r.p.m., 200,000 lb. per hour. The circulating-pump driving arrangements are somewhat unusual. A lift of about 30 ft. to the top of the condenser requires some 700 h.p. at the start, but when normal working establishes a siphonic action the power required is reduced to about half. To meet these conditions a motor of 700 h.p. at a two-hour rating and of 350 h.p. continuous rating is directly connected to the turbine pumps. On the same shaft is arranged a smaller machine which, when siphonic action has been established, is cascade connected with the larger motor, reducing the speed from 367 to 289 r.p.m., and the output capacity to 350 h.p. The motors are supplied direct at 6,600 V. At the river inlet are four "Brackett" water screens driven through two-speed gearing. In the condenser basement is a little electrically-driven exhauster pump by means of which any pump in the building can be primed.

Each alternator is directly coupled to the turbine shaft and is ventilated on the closed-feed system by air passed through water-treated air coolers, the water for this purpose being pumped from the well. The alternator fan is carried on the main shaft. The excitation of the alternator is stabilised by means of main and auxiliary exciters on the same shaft, the auxiliary machine exciting the main one at constant voltage by virtue of its saturated magnetic circuit.

The main switchgear is all of the vertical-isolation type of Ferguson Pailin, Ltd., and is located in a special house adjacent to the turbine room and served by a crane and a railway siding. There are two galleries at different levels containing the two sizes of switchgear: 1.5 million kVA rupturing and 2,000 A carrying capacity on the lower level, and 0.5 million kVA (400 A) on the higher gallery. The higher-capacity equipment is all for 11,000-V working and serves for the generator controls and some of the larger outgoing circuits. Some of the lower-capacity switchgear operates on the 6,600-V coupling feeders between the undertaking's two generating stations; the other provides for 11,000-V outgoing feeders. The bus-bars are duplicated, and two breakers are incorporated in each circuit. Under the upper gallery are located Hackbridge 10,500-kVA transformers for the station interconnectors, 11,000 6,600 V. The whole of the main switchgear is, of course, electrically operated from the control room. There is little that is unusual in this section, and the equipment is of the standard "open-panel" type supplied by Messrs. Ferguson Pailin, Ltd. The control boards are arranged in three main sections, two for the 11,000-V equipment and one for the 6,600-V gear. Over the boards are mounted the usual connection diagrams. Voltage regulation on the station couplers by "on load" tap changing on the transformers is effected by push buttons. The equipment in this room also includes temperature recorders for all the transformers, and also Hopkinson telegraph signalling equipment to the turbine room, &c.



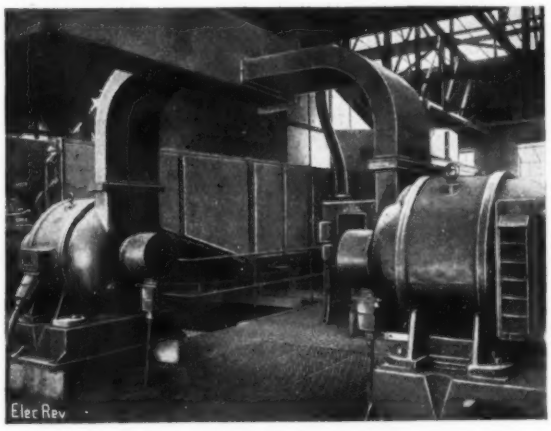
Top of Boiler; Periscopes for Water Gauges

Practically all the works auxiliaries are supplied at 346 V, 3-phase, and the supply, except for the coal-treatment section, is obtained from a works sub-station arranged on a gallery on one side of the turbine room. A notable feature of the station is its laboratory. This is

Fuel-feeder Arrangements: Vacuum Exhauster on Floor

adequately equipped for carrying out all the testing requirements of a modern station: coal, water, oil, and so on. A particularly interesting piece of apparatus in this department is a special machine for determining the fineness of the powdered fuel. A series of sieve trays of different standard meshes is arranged one over the other progressively in order of fineness (coarse mesh at the top). A coal sample is put in the top tray and a horizontal arm operated by a small motor continually taps the top of the apparatus, so that the fuel falls through the sieves until it is arrested by a mesh too small to allow it to pass. The qualified chemist in charge of this department is proud of the fact that his "lab." is all-electric.

A word should be said about the station lighting; it is good. The turbine, control, and switch rooms are all equipped with "Holophane" units. In the turbine room there are eight heavy-duty intensive units equipped with 1,000-W lamps mounted immediately above the crane. The control room, a night photograph of which is reproduced on p. 541, is illuminated by three rows of extensive industrial units, about 50 in all, equipped with 200-W lamps and mounted at approximately 17.5 ft. above floor level. There are two lines of fittings with different capacity lamps in the switch room. Over the 1.5 million kVA switchgear intensive-type heavy-duty units with 500-W lamps are installed, and over the lower-capacity equipment extensive units with 300-W lamps are employed. Arrangements have been made for flood-lighting the building at night, a 500-W projector unit being arranged opposite each brick pier of the building and equipped with a rectangular lens, giving the effect of ribbons of light right up to the tops of the piers, see illustration on p. 541.



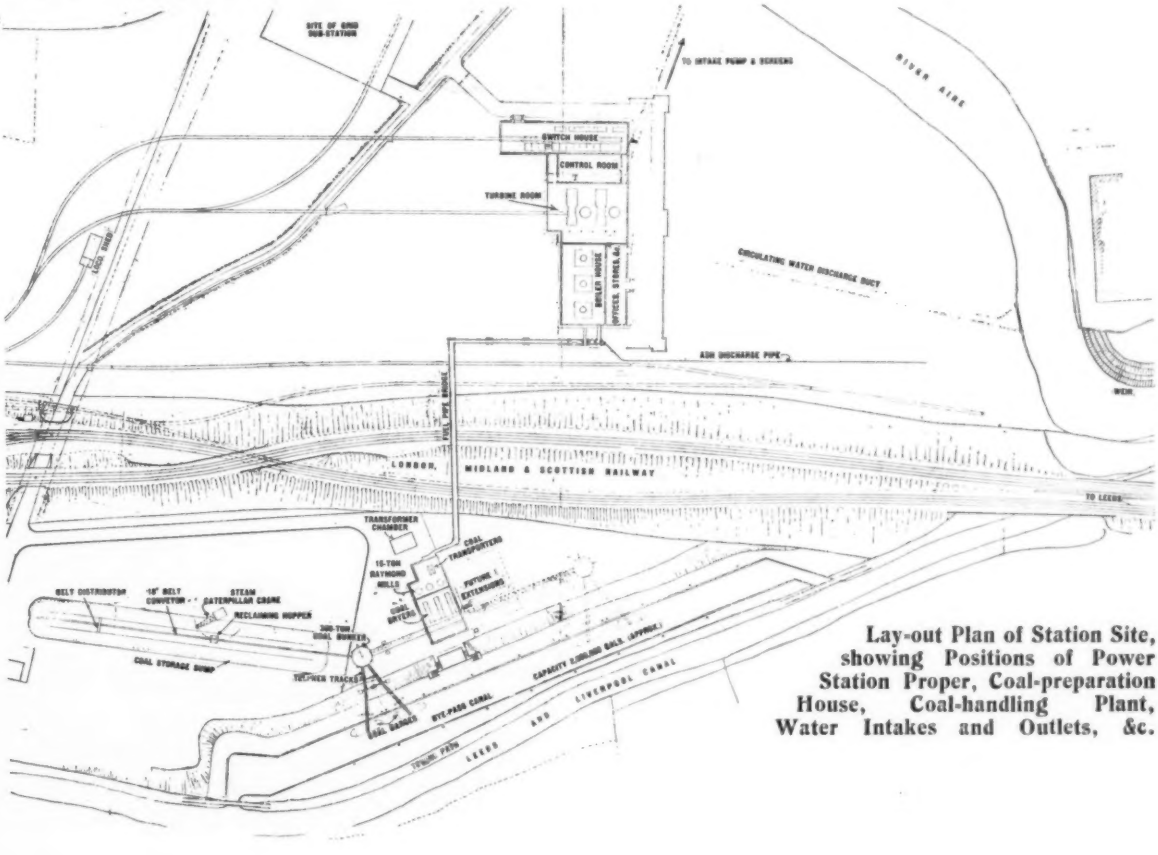
I.D. Fans and Control Gear

Arrangements have been made to facilitate extensions to the station in the future, the existing turbine room having a temporary end facing north-west. It is estimated that the total capital cost of the station when it is developed to its ultimate plant capacity will be £2,000,000. The capital cost of the initial section of the station, including the feeder switchgear, amounts to £780,000, or £15.6 per kW of plant installed.

Practically all the motors in the station were supplied by T. Harding Churton and Co., Ltd. The power-station buildings are carried on a substantial reinforced raft in which are incorporated the circulating-water intake and discharge ducts. The whole of the excavation and concrete work was executed by Harold Arnold & Son, Ltd. The steelwork is entirely of British manufacture and was supplied by Samuel Butler & Co., Ltd. The building work proper was carried out by Wm. Airey and Son (Leeds), Ltd., who had as the sub-contractor for the terra cotta work referred to earlier the Leeds Fireclay Co., Ltd.

The maximum load on the Leeds undertaking now exceeds over 64,000 kW, for an output of 150,000,000 kWh per annum, the annual load factor being in the neighbourhood of 27 per cent.

Our thanks are due to Mr. Hefford, who has been entirely responsible for the design and specification of the works, for permission to view the station and to take photographs, and to Mr. J. F. Sarvent, resident engineer at Kirkstall, and his assistant, Mr. T. R. Hoyle, and to Mr. E. O. Williams, technical assistant, for their help in the collection of the above information.



Lay-out Plan of Station Site, showing Positions of Power Station Proper, Coal-preparation House, Coal-handling Plant, Water Intakes and Outlets, &c.

An A.C. System of Distribution

Oil circuit breakers are installed in the power station only, adjacent sub-stations being supplied from different feeders

By J. P. HESLOP, Graduate I.E.E.

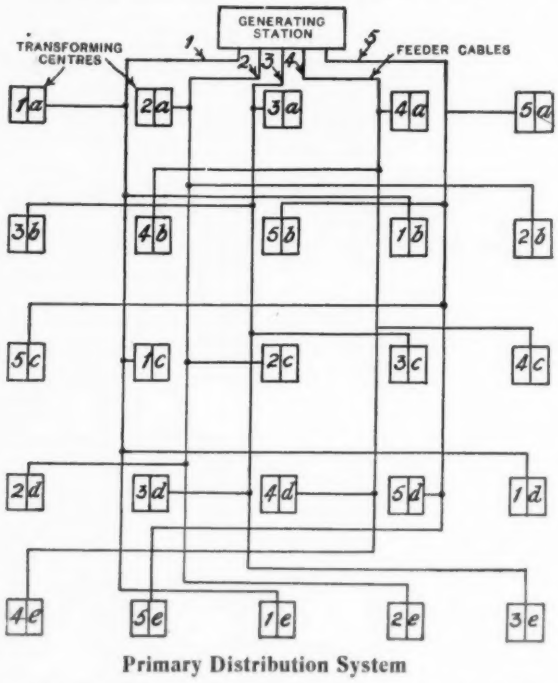
THE system described is claimed to possess the flexibility and economy of a.c. with the reliability of d.c. operation. Below is shown diagrammatically an area fed from a generating station by means of five h.p. feeders connected directly to the transformers sub-stations. The layout is a departure from the ring-main radial, and interconnected systems of feeders hitherto employed, in that the oil-circuit breakers are limited to the feeders leaving the generating station.

(1) *Feeders.*—No two adjacent sub-stations are connected to the same feeder. Reserve capacity will allow one feeder and its dependent transformers to be disconnected, by the oil-switch in the generating station and by the automatic secondary switches on the l.p. side. The amount of reserve feeder and transformer capacity is an inverse function of the number of feeders serving the area; in the present case five feeders will call for 20 per cent. reserve capacity.

In the generating station, current limiting reactors are provided on each feeder, and voltage regulators are most easily arranged on the bus-bar sections.

The absence of h.p. switchgear at the sub-stations allows, with this system, a higher economic voltage than is usually the case.

(2) *Transformers.*—The transformers employed in this system are designed with a reactance as high as from 7 to 10 per cent. in order to insure even distribution of load between sub-stations and also to limit, in certain instances, the fault current. An alternative method with lower-reactance transformers is to provide



Primary Distribution System

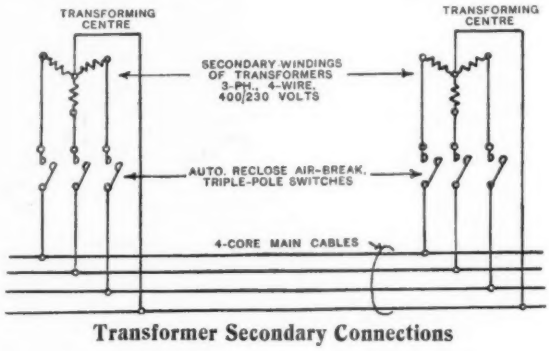
an external single-turn, iron-cored reactor in the transformer secondary neutral lead. For British use, the poorer voltage regulation entailed will perhaps militate against such a high transformer reactance as 10 per cent.

As the principle of the system involves the use of multiple l.p. feeding points, the number of which is increased as the load density increases, there is no tendency to make the transformer capacity above 800 kVA, which may be installed as a single unit.

(3) *Low-pressure Auxiliaries.*—The use of automatic, reclosing airbreak switches in the secondary is the great departure from standard practice, and was developed to avoid back feed from the mains under abnormal operating conditions. Each switch is connected directly to a transformer secondary on one side and to a secondary main cable on the other.

The connection of the switches to the secondary mains and to the transformers is shown by the smaller diagram. Their duties under various conditions of the system may best be described as follows:—

(*a*) To close the circuit between the transformer secondary and the low-pressure mains when the voltages


TRANSFORMING CENTRE
TRANSFORMING CENTRE
SECONDARY WINDINGS OF TRANSFORMERS 3-PH., 4-WIRE, 400/230 VOLTS
AUTO. RECLOSE AIR-BREAK, TRIPLE-POLE SWITCHES
4-CORE MAIN CABLES

Transformer Secondary Connections

of the secondary mains and the transformer are approximately in phase, and when the voltage of the latter exceeds the former sufficiently to cause forward power to flow. It will be noticed that this feature will not allow circuit closing if there exists a reversed phase, to achieve which the relay operating coils must be capable of withstanding double the phase voltage.

(*b*) To open the circuit in the event of a failure of the feeder cable or of the distribution transformer, in order to prevent power from the low-pressure mains and other sub-stations flowing into the fault.

(*c*) To open the circuit in the event of the opening of the generating station feeder switch or if power is cut off for any other reason. This feature requires that the switch shall open on the magnetising current of one or more transformers when supplied from the low-pressure secondary mains.

Special precautions are necessary in the characteristics of the relays to prevent the rapid opening and closing of the switches due to changes in the direction of the current, which can occur at times of low or uneven loadings in the area being fed. Also with feeders operating at the higher voltages, the charging current of the cable due to capacity reactance will, when fed from the secondary mains, lead the voltage to an extent sufficient to cause incorrect operation.

(4) *Low-pressure Mains.*—In existing systems employing this method of distribution, the secondary low-pressure network as a rule consists of single-core l.c. cables for the phases and a similar or bare conductor for the neutral. The primary object of this is the avoidance of faults between phases, limiting them to phase-to-neutral with the idea of facilitating a burning off of faults. The fault on a cable in this type of system commencing with a leak to the sheath rapidly develops into a low resistance path which eventually promotes an arc between the conductor and the sheath. The fault current consequent upon the starting of the arc rises until the sheath and then the copper conductor are melted, and results in the fault automatically clearing itself, thus avoiding an interruption to service. Low voltage in a particular stretch of main cable where the fault is situated will lead to investigation and repair of the cable.

Residential Heating

The Demand Made by Luminous Radiators in an All-electric House Creates an Economic Problem

By ALFRED EKSTROM, D.Sc., M.I E.E., and VIDAR EKSTROM

THE articles recently published in the lay Press regarding electricity prices show how deeply rooted is the public opinion that the result of the construction of the national supply system will be a substantial reduction in the price of electricity.

Since the Central Board will make a running charge of about 0.25d. per kWh, it should be possible to reduce the price to the consumer to about 0.5d. per kWh for all kinds of domestic consumption, provided that an adequate additional annual charge is made per domestic consumer to cover fixed costs. It will be of interest to consider how a two-part tariff, meeting the public desire for a low running charge, should be arranged. On the other hand, a price of about 1d. per kWh for cooking is quite a reasonable price if compared with the present price of gas in England. If, however, it is to be possible for the undertakings to supply energy on a large scale for heating water for the kitchen and for baths, it will be necessary to reduce the price of electricity for this purpose to about 0.5d. per kWh.

It would, of course, seem suitable to make only one running charge of, say, 0.5d. per kWh, whether the energy be used for lighting, cooking, water-heating, the heating of rooms, or any other purpose. We will investigate, in some typical practical examples of domestic consumption, the effect such a price would have on the additional fixed annual charge which would be necessary to give the supply undertaking a reasonable financial return. In all these examples we assume the following:—

1. The average consumer comprises five persons, having a house with six rooms.
2. The supply undertaking buys energy in bulk from a feeding centre belonging to the national supply system at a price of £3 10s. per maximum kW, plus 0.23d. per kWh.
3. The average energy losses in the distribution plant from the feeding centre to the average consumer are 25 per cent.
4. The annual cost for distribution is: Interest, 8 per cent.; depreciation, 3 per cent.; management and upkeep, 5 per cent., making a total of 16 per cent., all calculated on the initial cost of the distribution plant.

Example 1.—The distribution plant is assumed to be built for supplying an annual average consumption of 50 kWh per head for lighting and for sundry portable domestic appliances, such as irons and vacuum cleaners, *i.e.*, 250 kWh per consumer per annum at an average maximum demand of 0.25 kW. The plant is constructed for a maximum of from 0.25 to 0.50 kW per average consumer, involving an initial cost per consumer varying from £15 to £30. These figures accord with actual costs from 25 supply undertakings in England, where the industrial loads are practically negligible in comparison with the domestic loads. The lower figure is valid only for places where there is a great density of population and where conditions are very favourable for the construction of distribution lines.

Example 2.—The distribution plant is assumed to be built for the same purposes as in Example 1, plus about 350 kWh per person per annum for cooking, *i.e.*, a total of 2,000 kWh per consumer per annum, at an average maximum demand of 1 kW per person. The plant is constructed for a maximum of 1.0 to 1.25 kW per average consumer, involving an initial cost per consumer varying from £20 to £40.

Example 3.—The distribution plant is assumed to be built for the same purpose as in Example 2, plus 2,000 kWh per consumer per annum for water heating. This is sufficient to heat about 2 gallons of water per person daily from 50 to 185 deg. F., assuming a thermal storage system with an efficiency of 70 per cent. This quantity of water should meet the requirements of the average kitchen and scullery. We assume that of these 2,000 kWh, 1,500 will be consumed during the night. The annual day load of $5 \times 500 = 2{,}500$ kWh will make a maximum demand of 1.25 kW. The annual day and night consumption is 4,000 kWh.

The distribution plant is constructed for a maximum of 1.25 to 1.50 kW per consumer, involving an initial cost per consumer varying from £25 to £50.

Example 4.—The distribution plant is assumed to be built for the same purposes as in Example 3, plus an additional 3,000 kWh per annum for water heating for baths (one to two baths a day per consumer). We assume that of the 5,000 kWh consumed for water heating (2,000 for kitchen and scullery and 3,000 for baths), 4,000 can be produced during the night. The annual day consumption of 3,000 kWh will necessitate a maximum demand of 1.5 kW. The annual day and night consumption is 7,000 kWh.

The distribution plant is constructed for 1.5 to 2.0 kW, involving an initial cost per consumer varying from £30 to £60.

Example 5.—The distribution plant is assumed to be built for the same purpose as in Example 4, but it is also capable of supplying a day load of 3,000 kWh per consumer per annum for electric radiators for the entire

TABLE I.

	Example I.	Example II.	Example III.	Example IV.	Example V.
1. kWh per annum taken by consumer	Day. 5×50=250	Day. 5(50+350) =2,000	Day. Night. 5(50+350+100+300) =4,000	Day. Night. 5(50+350+2 0+800) =7,000	Day. Night. 5(50+350+200+600+800) =10,000
2. Load-factor at main transf. centre...	0.116	0.23	0.37	0.54	0.1:4
3. Equiv. hours use of max. demand ...	1,00)	2,000	3,200	4,667	1,333
4. kW of distribution plant per consumer	0.25 to 0.5	1.00 to 1.25	1.25 to 1.50	1.50 to 2.0	4.0 to 5.0
5. Capital cost of distribution plant ...	£ s. d. £ s. d. 15 0 0 30 0 0	£ s. d. £ s. d. 20 0 0 40 0 0	£ s. d. £ s. d. 25 0 0 50 0 0	£ s. d. £ s. d. 30 0 0 60 0 0	£ s. d. £ s. d. 60 0 0 120 0 0
6. Consumer's share of m.d. at feeding centre, kW, excl. energy losses	0.25	1.00	1.25	1.50	7.50
7. At £3 10s. per kW. plus 25% losses...	1 3 4 1 3 4	4 13 4 4 13 4	5 16 8 5 16 8	7 0 0 7 0 0	25 0 0 25 0 0
8. kWh at 0.23d. plus 25% losses ...	0 6 5 0 6 5	2 11 1 2 11 1	5 2 3 5 2 3	8 18 11 8 18 11	12 15 7 12 15 7
9. Distribution cost 16% of item 5 ...	2 8 0 4 16 0	3 4 0 6 8 0	4 0 0 8 0 0	4 16 0 9 12 0	9 12 0 19 4 0
10. Total cost	3 17 9 6 5 9	10 8 5 13 12 5	14 18 11 18 18 11	20 14 11 25 10 11	57 7 7 66 19 7
11. Running charge at ½d. per kWh ...	0 10 5 0 10 5	4 3 4 4 3 4	8 6 8 8 6 8	14 11 8 14 11 8	20 16 8 20 16 8
12. Total fixed annual charge	3 7 4 5 15 4	6 5 1 9 9 1	6 12 3 10 12 3	6 3 3 10 19 3	36 10 11 46 2 11
13. Total fixed annual charge per room	0 11 3 0 19 3	1 0 10 1 11 6	1 2 0 1 15 4	1 0 6 1 16 6	6 1 10 7 13 8
14. Light, 250 kWh	3 17 9 6 5 9 (3.73d.) (6.04d.)	3 17 9 6 5 9 (3.73d.) (6.04d.)	3 17 9 6 5 9 (3.73d.) (6.04d.)	3 17 9 6 5 9 (3.73d.) (6.04d.)	3 17 9 6 5 9 (3.73d.) (6.04d.)
15. Cooking, 1,750 kWh	—	6 11 3 7 5 10 (0.9d.) (1.0d.)	6 11 3 7 5 10 (0.9d.) (1.0d.)	6 11 3 8 0 5 (0.9d.) (1.1d.)	7 5 10 8 0 5 (1.0d.) (1.1d.)
16. Water, 2,000 kWh for kitchen and scullery	—	—	4 3 4 5 0 0 (0.5d.) (0.6d.)	4 3 4 5 0 0 (0.5d.) (0.6d.)	5 0 0 5 0 0 (0.6d.) (0.6d.)
17. Water, 3,000 kWh for baths ...	—	—	—	6 5 0 6 5 0 (0.5d.) (0.6d.)	6 5 0 6 5 0 (0.5d.) (0.6d.)
18. Radiators, 3,000 kWh	—	—	—	—	84 17 6 41 7 6 (2.79d.) (3.31d.)
19. Totals	3 17 9 6 5 9	10 9 0 15 11 7	14 12 4 18 11 7	20 17 4 25 11 2	57 6 1 66 18 8
20. Average cost, pence per kWh	3.73 6.04	1.25 1.63	0.88 1.11	0.71 0.88	1.37 1.61
21. Running charge at 1d. per kWh day, and at 0.5d. per kWh night	1 0 10 1 0 10	8 6 8 8 6 8	13 10 10 13 10 10	20 16 8 20 16 8	33 6 8 33 6 8
22. Total fixed annual charge	2 16 11 5 4 11	2 1 9 5 5 9	1 8 1 5 8 1	— 4 14 3	24 0 11 33 12 11
23. Total fixed annual charge per room	0 9 6 0 17 6	0 6 11 0 17 7	0 4 8 0 18 0	— 0 15 8	4 0 2 5 12 2

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The British Electrical and Allied Manufacturers' Association sustained heavy losses by death during the year 1930. Though they were recorded here separately as they occurred and are known to our readers, their aggregate effect becomes more obvious as one reads the references appearing in the annual report of the Association. The death of Sir Benjamin Longbottom, who for so long devoted himself unsparingly to B.E.A.M.A. interests, occurred shortly after the last annual meeting, and not many weeks after the profession and industry mourned the loss of Dr. Ferranti. The year's toll also included Messrs. E. Garcke and A. E. Seaton, both of them vice-presidents; and Messrs. J. P. Gregory and C. C. Wharton, two valued committee members. The changes of the year include the election of **Sir Felix Pole, Sir Holberry Mensforth,** and **Mr. W. C. Lusk** as vice-presidents. Further, **Sir Philip Nash,** of the Metropolitan-Vickers Electrical Co., Ltd., took the seat on the Council vacated by **Mr. McKinstry,** retired; **Mr. G. J. Scott** became the representative on the Council, of Messrs. Laurence, Scott & Electromotors, Ltd.; and **Mr. Frank Parkinson,** of Crompton Parkinson, Ltd., was co-opted a member of the Council. From the staff, Mr. H. Quigley left the Economic and Statistical Department to take up his appointment as chief statistical officer to the Central Electricity Board.

Mr. Oliver R. H. Bury, presiding at last week's meeting of the London Electric Supply Corporation, Ltd., referred to the appointment of the **Earl of Bessborough,** the chairman of the company, as Governor-General of Canada. He also mentioned that on account of continued ill-health, **Mr. G. W. Partridge,** the manager and chief engineer, had thought it wise to relinquish his active participation in the management of the company. Mr. Partridge was, however, to remain on the board of directors. His retirement necessitated the appointment of a new manager and chief engineer, and the position had been filled by **Mr. J. G. Freeman,** who had been superintendent engineer.

Mr. A. Yate, who was for 18 years Scottish representative of the Hart Accumulator Co., Ltd., has joined Britannia Batteries, Ltd. His address is 27a, Cadogan Street, Glasgow.

Sir J. Ambrose Fleming, F.R.S., is to be presented with the 1930 Duddell Medal at this afternoon's meeting of the Physical Society. This is the eighth award of the medal.

Mr. Maurice Barber, chairman of the Holmfirth U.D.C. Electricity Department, has been elected a member of the West Riding County Council.

Dr. Miles Walker, Professor of Electrical Engineering at the Manchester College of Technology, is recommended by the Council for election into the Royal Society.

Mr. S. F. Prest has been appointed chairman of the Parsons Marine Steam Turbine Co., Ltd., in succession to the late Sir Charles Parsons. **Mr. R. J. Walker** is to be vice-chairman and managing director of the company.

Mr. G. W. Keats, who is retiring from the position of borough electrical engineer of Woolwich, after 30 years' service with the undertaking, has been granted a superannuation allowance of £898 per annum.

Mr. W. B. Woodhouse, engineer and manager of the Yorkshire Electric Power Co., has been appointed a director of the Electrical Distribution of Yorkshire, Ltd.

Alderman R. S. Pilling, J.P., chairman of the Colne Electricity Committee, has been elected president of the Burnley and District Society of Architects.

Mr. S. E. Monkhouse was recently appointed assistant general manager of the Newcastle-upon-Tyne Electric Supply Co., Ltd.

The *Electrical Engineer of Australia and New Zealand* reports that **Mr. F. A. Robinson,** of the Robinson & Hands Electric Co., Ltd., was recently in New Zealand studying the radio market and investigating the possibilities of the local production of equipment.

Mr. F. Thompson, general manager of the Christchurch (N.Z.) Tramway Board is paying a visit to this country shortly.

Mr. F. H. Mann, M.I.E.E., of the firm of Moffett, Rosher and Mann, consulting engineers, is shortly severing his connection with that firm in order to take up an appointment under the Home Office as Electrical Inspector for the Scotland area. Mr. Mann joined Messrs. Moffett & Rosher in 1913. During the war he served with the Royal Naval Divisional Engineers, and in 1916 received a commission in the Royal Navy. In January, 1919, he was engaged by the Grimsby Corporation under the direction of Lt.-Col. Vignoles, in connection with the extension of the supply, including the layout of new generating and converting plant. In 1921 he rejoined Messrs. Moffett & Rosher. Mr. Mann takes up his new duties at the beginning of April.

Mr. E. S. Rayner, late manager of the Hull Corporation Tramways, has been presented by the employés at the Cottingham Road depôt with a coffee service and tray and a dinner wagon.

Obituary.

Dr. Florence Buchanan.—*The Times* reports the death, on March 13th, of Dr. Florence Buchanan, who for many years was engaged in electro-physiological research. She was awarded the degree of D.Sc. by the London University mainly for her paper on "the electrical response of muscle in different kinds of contraction."

Mr. T. Plummer.—The death occurred at Shrewsbury, on March 12th, of Mr. Thomas Plummer, formerly superintending engineer of the North Wales District of the General Post Office.

Mr. J. McLaren.—The death occurred recently, at the age of 72, of Mr. James McLaren, public works contractor, Newcastle, who was a director of the Seahouses & District Electric Lighting Co.

Mrs. Forrest.—Much sympathy is felt for Mr. Frank Forrest, city electrical engineer of Birmingham, on the death of his wife, which occurred on March 8th at their residence, 111, Handsworth Wood Road, Birmingham.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Bullturn Radio, Ltd.—Private company. Registered March 10th in Edinburgh. Capital, £2,000 in £1 shares. Objects: To carry on the business of radio, electrical, and general engineers. &c. The subscribers are:—A. A. M. Turnbull, 9, Bank Street, Glasgow, W.2, electrical engineer; J. M. P. Millar, 18, Holywood Crescent, Edinburgh, clerk. Secretary: J. M. P. Millar. Registered office: 122, West Campbell Street, Glasgow.

Wireless Supplies and Repairs, Ltd.—Private company. Registered March 11th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers and repairers of or dealers in wireless and electrical apparatus, motors, motor cycles, gramophones, &c. The subscribers (each with one share) are:—A. Dutton, 25, Ribble Avenue, Crossens, Southport, and W. S. Barstow, 70, Duke Street, Southport, electrical engineers. A. Dutton is the first and permanent director. Registered office: 14, Princes Street, Southport.

E.K.C.O., Ltd.—Private company. Registered March 12th. Capital, £100 in 1s. shares. Objects: To carry on the business of manufacturers of and/or dealers in instruments, appliances or processes for receiving or transmitting wireless, sound amplifying and recording apparatus and television, &c. The subscribers (each with one share) are:—W. S. Verrels, "Ninety-Seven," Kings Road, Westcliff-on-Sea, company director; E. K. Cole, "Leeways," Marine Parade, Leigh-on-Sea, company director. Solicitors: Woodhouse & Co., 5/6, Clements Inn, W.C.2.

D.E.C., Ltd.—Private company. Registered March 12th. Capital, £1,000 in 2,000 ordinary shares of 1s. and 900 15 per cent. cumulative preference shares of £1 each. Objects: To acquire any interest in patents relating to improvements in illuminating service for simulating daylight, and to carry on the business of electrical and mechanical engineers, suppliers of electricity for light, heat and motive power, &c. The permanent directors are:—A. R. St. Clair, 21, Northumberland Court, Newcastle-on-Tyne; B. Gill, 26, Northumberland Street, Newcastle-on-Tyne; C. T. Glenn, 5/7, Saville Row, Newcastle-on-Tyne. Secretary: R. J. Shields. Registered office: 5/7, Saville Row, Newcastle-on-Tyne.

British Radio Manufacturing Co. (Liverpool), Ltd.—Private company. Registered March 12th. Capital, £100 in £1 shares. Objects: To acquire the business of a wireless apparatus manufacturer and retailer heretofore carried on by C. G. Williams at 9, South Castle Street, Liverpool. The directors are:—C. G. Williams and Mrs. S. Williams, 86, Rullerton Road, Wallasey, Cheshire. Secretary: G. Castell. Solicitors: Herbert J. Davis, Berthen & Munro, 36, Dale Street, Liverpool.

Hanson Electrical Supplies, Ltd.—Private company. Registered March 11th. Capital, £200 in £1 shares. Objects: To carry on the business of dealers in electrical apparatus and appliances, &c. The directors are:—F. W. Hanson, 11, Grasmere Road, Woodside, S.E.25, electrician; R. C. Redmond, 45, Burlington Road, Bayswater, W.2, electrician; E. G. W. Wallis, 30, Monmouth Road, W.2. Secretary: R. C. Redmond.

Jackson-Bell Distributors, Ltd.—Private company. Registered March 7th. Capital, £2,000 in £1 shares. Objects: To adopt an agreement with the Jackson-Bell Company, and to carry on the business of distributors of the Jackson-Bell midget radio receivers and products of the Jackson-Bell Company of Los Angeles, California. The subscribers are: B. L. Ratcliffe, 68, Victoria Street, S.W.1; R. Goetz, 26, Roland Gardens, S.W.7; W. E. Skipp, 86, Cannon Street, E.C.4. Registered office: 68, Victoria Street, S.W.1.

Brilliant Neon, Ltd.—Private company. Registered March 9th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in neon signs, showcases, shop-fronts, shop fittings, &c. The directors are: F. G. Lucas, 131, Uxbridge Road, W.12; W. D. Lambert, 163, Gunnersbury Lane, W.3. Secretary: H. Lawrence. Registered office: 131, Uxbridge Road, W.12.

Adalite, Ltd.—Private company. Registered February 28th. Capital, £100 in £1 shares. Objects: To acquire or work under licence, patent No. 325,349 for an improvement in or relating to apparatus for advertising; to carry on business in electrical and other advertising novelties and specialities, &c. The directors are: A. L. Gunn, 31, Normanton Road, Croydon (director of Johnson Riddle & Co., Ltd.); R. I. M. Samuel, 37, Brooke Street, E.C., journalist. Registered office: 48, Great Sutton Street, E.C.1.

Radio-Aid, Ltd.—Private company. Registered February 28th. Capital, £100 in 5s. shares. Objects: To carry on the business of inventors, designers, and manufacturers of, agents for, and dealers in electrical acoustic apparatus and accessories, electrical, wireless, and general engineers and engineering contractors, &c. The directors are: T. B. Smith, Pednor Close, Chesham, Bucks; F. P. Sexton, A.M.I.E.E., 15, Lingfield Avenue, Kingston-on-Thames; A. Day, B.Sc., 3, Cadogan Road, Surbiton.

Official Returns of Electrical Companies.

L. Benn & Co., Ltd.—Debenture dated February 25th, 1931, to secure £1,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Miss C. Davis, 134, Acre Lane, Brixton.

Electrical and Radio Products, Ltd.—Issue on February 20th, 1931, of £1,000 debentures, part of a series already registered.

Electradio Co., Ltd.—S. Croft, 58, Coleman Street, E.C.2, was appointed receiver and manager on February 27th, 1931, under powers contained in debenture dated November 21st, 1927.

Naider Bros. & Thompson, Ltd.—Capital, £30,000 in 15,000 preference and 15,000 ordinary shares of £1 each. Return dated December 3rd, 1930. 14,968 preference and 14,849 ordinary shares taken up. £13,881 paid. £15,936 considered as paid. Mortgages and charges, nil.

Prangnell Partners, Ltd.—Capital, £1,000 in £1 shares. Return dated January 12th, 1931. 962 shares taken up. £174 10s. (£1 per share on 12 and 5s. per share on 650 shares) paid up in cash. £300 considered as paid on 300 shares. Mortgages and charges, nil.

Dean & Noble, Ltd.—Capital, £1,000 in £1 shares. Return dated November 12th, 1930. All shares taken up. £1,000 considered as paid. Mortgages and charges, nil.

Sudan Light and Power Co., Ltd.—Capital, £450,000 in 94,000 preference and 356,000 ordinary shares of £1. Return dated October 31st, 1930. 52,000 preference and 356,000 ordinary shares taken up. £408,000 paid. Mortgages and charges, £400,000.

Stearn Electric Co., Ltd.—Capital, £4,000 in £1 shares. Return dated November 26th, 1930. All shares taken up. £2 paid. £3,998 considered as paid. Mortgages and charges, £9,700.

Synchronome Co., Ltd.—Capital. £7,000 in 600 preference, 5,000 non-cumulative second preference, and 1,400 ordinary shares of £1 each. Return dated December 8th, 1930. 600 preference, 4,200 second preference, and 1,400 ordinary shares taken up. £700 paid. £5,500 considered as paid. Mortgages and charges, nil.

Ross Electric Light and Power Co., Ltd.—Satisfaction to the extent of £1,450 on May 22nd, 1930, of debentures authorised by resolution dated July 30th, 1925, and registered March 30th, 1926. (According to the register of mortgages, the debentures registered March 30th, 1926, originally secured £1,450.) (Notice filed March 9th, 1931.)

London Radio Manufacturing Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 14th, 1931. All shares taken up. £700 paid. £300 considered as paid. Mortgages and charges, nil.

H. Stanley, Ltd.—H. Robertson, 15, Kendal Road, Dollis Hill, N.W.2, was appointed receiver and manager by Order of Court dated February 24th, 1931.

Aldwych Electrical, Ltd. (formerly H. A. C. (Electrical) Works, Ltd.).—Particulars filed of £2,250 debentures authorised by resolutions of December 23rd, 1930, and February 27th, 1931, charged on the company's undertaking and property, including uncalled capital and goodwill, the whole amount being now issued.

Oxford Electric Co., Ltd.—Satisfaction to the extent of £60,000, plus £2,100 premium on redemption, on December 1st, 1930, of trust deed dated June 1st, 1923, and registered June 15th, 1923, securing £60,000 6 per cent. debenture stock, plus a premium of 3½ per cent. (Notice filed March 4th, 1931.)

Keighley Electrical Engineering Co., Ltd.—Capital, £10,000 in 3,000 preference and 7,000 ordinary shares of £1 each. Return dated September 12th, 1930. 2,300 preferred and 4,200 ordinary shares taken up. £4,488 paid. £2,012 considered as paid. Mortgages and charges: Floating charge stamped to cover £4,000.

Wolf & Morgan, Ltd.—Capital, £1,000 in £1 shares. Return dated December 15th, 1930. All shares taken up. £1,000 paid. Mortgages and charges, £6,250.

Selfix Electric Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 13th, 1931. 691 shares taken up. £335 paid. £356 considered as paid. Mortgages and charges, nil.

Brownie Wireless Co. (Great Britain), Ltd.—Capital, £10,000 in £1 shares. Return dated December 31st, 1930. 9,720 shares taken up. £9,720 paid. Mortgages and charges, £7,000.

Robinson & Hands Electric Co., Ltd.—Capital, £5,000 in 20 ordinary and 4,980 preference shares of £1 each. Return dated November 7th, 1930. 20 ordinary and 4,232 preference shares taken up. £4,252 paid. Mortgages and charges, nil.

Vortexion, Ltd.—Debenture dated March 10th, 1931, to secure £500 charged on the company's undertaking and property, present and future, including uncalled capital. Holder: Miss E. M. de Lisle, 9, Denmark Avenue, Wimbledon, S.W.19.

Fraser Mares, Ltd.—L. S. Findlay, 35, Windsor Place, Cardiff, was appointed receiver and manager on March 9th, 1931, under powers contained in debenture dated February 23rd, 1926.

Radions, Ltd.—J. H. Noble, 21, Jordangate, Macclesfield, ceased to act as receiver and manager on March 7th, 1931.

Sterling Telephone & Electric Co., Ltd.—Capital, £65,000 in 49,650 preference and 15,350 ordinary shares of £1 each. Return dated January 13th, 1931. 39,500 preference and 15,350 ordinary shares taken up. £24,500 paid. £30,350 considered as paid. Mortgages and charges: nil.

Davis Electrical Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1930. 677 shares taken up. £377 paid. £300 considered as paid. Mortgages and charges, nil.

Orion Lamps, Ltd.—Capital, £2,000 in £1 shares. Return dated October 14th, 1930. 1,245 shares taken up. £1,245 paid. Mortgages and charges, nil.

India Rubber, Gutta Percha & Telegraph Works Co., Ltd.—Capital, £1,250,000 in 750,000 ordinary, 250,000 preference and 250,000 unissued shares of £1 each. Return dated December 11th, 1930. 750,000 ordinary and 250,000 preference shares taken up. £1,000,000 paid in cash. Mortgages and charges, £400,000.

Burma Electric Supply Co., Ltd.—Capital, £270,000 in 150,000 preference and 120,000 ordinary shares of £1. Return dated December 10th, 1930. 120,000 preference and 120,000 ordinary shares taken up. £100,000 paid on 100,000 preference shares. £140,000 considered as paid on 20,000 preference and 120,000 ordinary shares. Mortgages and charges, nil.

Hallwood & Ackroyd, Ltd.—Capital, £25,000 in 3,200 preference and 1,800 deferred shares of £5 each. Return dated October 18th, 1930. All shares taken up. £15,500 paid on 3,100 preference shares. £9,500 considered as paid on 100 preference and 1,800 deferred shares. Mortgages and charges, £50,000 sealed debentures.

Venezuela Telephone & Electrical Appliances Co., Ltd.—Capital, £600,000 in 140,000 preference, 140,000 ordinary and 320,000 "A" ordinary shares of £1 each. Return dated January 2nd, 1931. 136,975 preference, 136,975 ordinary and 136,975 "A" ordinary shares taken up. £354,419 paid in cash on 136,975 preference, 80,469 ordinary and 136,975 "A" ordinary shares. £56,506 considered as paid on 56,506 ordinary shares. Mortgages and charges, £145,300.

City Notes.

London Electric Supply Corporation, Ltd.

The accounts of this company were abstracted in our issue of March 6th, p. 391, and the annual meeting was held on March 13th. Mr. O. R. H. Bury, who presided, in the course of his speech, said the capital expenditure during the year was £127,042, the principal items being £70,697 for mains, £27,872 on electrical instruments, and £11,087 on distribution stations and offices. The expenditure on mains was due, principally, to the laying down of the standard system of 50 cycles, a.c. During the year they had pushed forward the development of this system of supply, and the expenditure on distributing stations and electrical instruments was principally for the erection and equipping of sub-stations to furnish supplies on this system. The passage of the De-Rating Bill into an Act had operated as a distinct handicap to electricity undertakers in their efforts to persuade large users of power to take energy from the public supplies instead of continuing to generate their own electricity. The "all-in" domestic tariff had met with a gratifying response from consumers, and in order still further to encourage this system the company had decided to reduce the charge from 1d. to ¾d. per kWh during the two summer quarters. They were now establishing permanent showrooms, the first floor of which would be fitted up as a modern flat; electrically equipped throughout. On a site in Stamford Street they were erecting a building to accommodate the engineering staff and workmen, together with adequate stores and workshops. The report and accounts were adopted.

Metropolitan Electric Supply Co., Ltd.

The accounts of this company were abstracted in our issue of March 6th and the annual meeting was held on March 10th. Mr. G. Balfour (chairman), who presided, said in the course of his speech that their position had not only been maintained, but steady progress was being made in their outer London or Western area. The increased electrical energy sold last year in this area alone amounted to nearly 15 million kWh. They had made an offer to the ordinary shareholders of the Egham and Staines Electricity Co., Ltd., to acquire their holdings in exchange for ordinary shares of the Metropolitan Co., and the necessary acceptances had been received to enable them to go forward with these arrangements. During the year they settled the details of a pension fund for their employés, and the scheme was now in operation. Their average price for electricity had shown a consistent drop every year from 1924 and their "all-in service contract" was rapidly gaining ground, about one-third of the domestic consumers in the outer London area now being on this tariff. At the end of the current quarter they were making reductions in charges in many districts. District showrooms and offices had been opened in Southall and Slough, and they had acquired premises for a central office and showroom in Uxbridge. The output from the sub-stations amounted to 183,240,000 kWh, as compared with 166,950,000 kWh in the preceding year, while the connections increased by 23,838 kW to 196,678 kW. The total number of consumers connected at the end of the year, including those of their subsidiary companies, was 63,492. The report and accounts were adopted and at an extraordinary general meeting which followed, a resolution was passed increasing the capital of the company to £3,000,000 by the creation of 500,000 additional ordinary shares of £1 each.

Scottish Power Co., Ltd.

Considerable progress in the development of the company's undertakings has been made during 1930, states the directors' report. The hydro-electric works of the Grampian Co. at Loch Rannoch were completed and put into service at the end of November last. During the year there were issued 730,000 ordinary shares of £1 each and 650,000 6 per cent. cumulative preference shares of £1 each, of which 650,000 ordinary and 530,000 preference shares were issued for cash at a premium and the balance in settlement of the purchase price of the share capital of the Scottish Southern Electric Supply Co. Trading profits of the undertakings owned and operated by the company, together with the interest during the construction of the Grampian Co.'s hydro-electric works, amounted to £301,733. Out of the profits for the year an aggregate amount of £62,203 was reserved in the accounts of these undertakings. The balance at credit of profit and loss account, including £6,710 brought forward, amounts to £204,086, from which loan interest, &c., is deducted, leaving a balance of £170,227. The directors propose to pay a dividend on 2,430,000 ordinary shares for the year to December 31st, 1930, and 650,000 ordinary shares on instalments paid during the year at the rate of 8 per cent. per annum, less tax, leaving £5,380 to be carried forward.

Enfield Cable Works, Ltd.

The annual meeting was held on March 9th, the Earl of Verulam (chairman) presiding. In presenting the report and accounts (Elec. Rev., March 16th, p. 437), the chairman said the year had been one of increasing anxiety, and business had been more and more difficult to obtain. The result of the year's trading, however, had been a profit of £173,718, which constituted a record in the company's history. They had begun to feel the benefit of their super-tension plant and of the other heavy capital outlay which they had incurred during the past few years. So far as manufacturing was concerned, they were constantly studying the cost of each process in the factory and effecting economies which were accumulative and made for efficient work. To some extent, part of the increase in profit could be attributed to development in research, economies in methods of manufacture, and to their having bought raw materials cautiously on a falling market. Beyond this, the results were due to the fact that electrical developments in this country had gone forward in spite of general depression in industry all round. The Enfield Rolling Mills had had another good year and paid a dividend of 15 per cent., while the Australian company paid a dividend of 50 per cent. for the year ended September 30th, 1930. The report and accounts were adopted.

Kensington & Knightsbridge Electric Lighting Co., Ltd.

Presiding at the annual meeting on March 12th, Col. R. E. Crompton (chairman) said that the connections had increased by 13.1 per cent. to 41,278 kW, while the sales of electricity showed an increase of nearly 20 per cent., the total being 23,332,420 kWh. This increase in sales had been due to the connection of several large consumers during the year. The average price obtained per kWh was reduced from 2.23d. to 1.955d. The capital expenditure during the year was £50,728, most of which was necessitated in connection with the change of system from d.c. to a.c. Several sites for sub-stations were acquired during the year. The partnership between the Kensington and Notting Hill companies had terminated, as a natural consequence of the 1925 legislation. The whole of the debenture stock of the joint undertaking had been redeemed, and on completion of the winding-up of the joint undertaking the management committee would cease to function. Reviewing the progress made during the past eight years, the chairman said the sales had increased by 168 per cent., from 8,698,049 kWh in 1923 to 23,332,420 kWh last year, and the average price had fallen by 51 per cent. from 3.979d. to 1.955d. The report and accounts were adopted.

South London Electric Supply Corporation, Ltd.

The revenue account for 1930 shows a balance of £95,974, to which is added a balance brought forward (£98,861), less special rebate to consumers, making a total of £157,984. After deducting debenture interest, &c., transferring £5,000 to taxation reserve, £2,620 to contingency fund, £27,041 to sinking funds, and £19,000 to reserve, there is a balance of £103,063. It is proposed to pay a final ordinary dividend of 5½ per cent., making 8½ per cent. for the year, leaving £59,273 to be carried forward. The energy sold during the year totalled 29,921,272 kWh, an increase of 7,103,329 kWh. In December last an amount of £300,000 4½ per cent. debenture stock was sold on the market for the purpose of providing funds in connection with the changing of the system of distribution and the acceleration of development in the company's area of supply.

Charing Cross Electricity Supply Co., Ltd.

The annual meeting was held on March 11th, Mr. W. F. Fladgate (chairman) presiding. In presenting the report and accounts (Elec. Rev., March 6th, p. 436), the chairman said that, in spite of trade depression, and the consequent economy in the use of electricity by their City customers, they had been able to improve their position. The cause of this improvement was a steady growth of the load connected to their mains. There was great activity in rebuilding both in the City and the West End. New connections during the year totalled 3,800 kW. The sales of electricity in the West End showed an increase of 3¼ million kWh as compared with the preceding year, while in the City, where the total energy sold showed a small increase, the position was better than it looked, as although there was a decrease of over a million kWh in the bulk supply to the Post Office, there was an increase in the ordinary sales of more than that figure at a considerably more remunerative rate. The decrease in the Post Office supply must be considered as purely temporary. In both undertakings they had found it necessary to increase their plant, and as a further step towards economical working they had commenced the supply of h.p. alternating current. To do this they were laying a h.p. main throughout their area. The report and accounts were adopted.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The report for the year ended December 31st last shows a profit of £913,741, as compared with £876,351 in the preceding year. After providing for debenture interest, &c., and transferring £200,000 to reserve for special depreciation and contingencies, and £50,000 to reserve for plant renewals and improvements, there is a balance of £446,169, to which is added £96,029 brought forward, making £542,198 available. It is proposed to pay a final dividend of 3½ per cent. on the ordinary shares, making 6 per cent. for the year, and to carry forward £116,669. The capital expenditure amounted to £110,364, and mainly represented extensions to the distribution systems. The portion of the work in connection with the North-East England Electricity Scheme, 1929, which the company is carrying out is progressing satisfactorily. The report records the death of Mr. F. S. Newall, a director. The directors have appointed Mr. S. E. Monkhouse assistant general manager of the company. Meeting: March 24th.

Indian Radio Telegraph Co., Ltd.

A net profit of £51,000 is shown in the annual report. A dividend of 12½ per cent. has been declared on the ordinary shares and 8½ per cent. on the deferred shares, free of taxation. A sum of £14,175 has been carried forward.—*Reuter* (Bombay).

County of London Electric Supply Co., Ltd.

The annual meeting was held on March 17th, Sir Bernard E. Greenwell, vice-chairman, presiding. In presenting the report and accounts (ELEC. REV., March 13th, p. 481), the chairman said that the output from the Barking station for the year totalled 511,133,700 kWh, of which 447,488,860 kWh was sold, the sales showing an increase of 72,578,076 kWh. The connections increased by 50,942 kW to 384,772 kW, while there was an increase of over 40,000 in the number of new consumers supplied directly or indirectly. The rates were over £147,000, and the amount paid by the company, or by the shareholders, in Government, local authorities, and other levies totalled over £310,000, or one-sixth of the revenue received from the sale of electricity. The standard prices fell due for revision in the coming year, and new prices under the Act would operate as from January 1st, 1932. The present capacity of the Barking station was 240,000 kWh, and consent had been received to the installation of two 75,000-kW turbo-alternators. These would be the largest single sets to be installed in this country. The average cost of coal purchased during the year increased by 10½ per cent., but this was offset by the increased efficiency of the station. The aggregate length of cables laid to date throughout their area of supply was 3,200 miles, and there were 880 sub-stations. Satisfactory progress had been made in the development under their Essex scheme. Referring to the controversy regarding electricity and gas, the chairman said that everybody was faced with a natural economic change—a transition from the old methods to the modern form of electric drive. It was an economic change which had been expedited in the United States, in Germany and in other countries, and nothing could stop it. That an effort should be made to speed up that change in the national interests was no excuse for criticism of the Minister made responsible by Parliament for the electrical industry. In connection with the charges for electricity, it was obvious that it was cheaper for them to supply in populated urban areas than in sparsely populated outlying areas. Reductions made to consumers since 1928 had totalled £650,000. The travelling showroom had proved a great success. The report and accounts were adopted.

Lancashire Dynamo & Motor Co., Ltd.

A profit of £7,691 is shown in the report for 1930, after charging depreciation and debenture interest. The profit in the preceding year was £18,158. A balance of £7,227 brought forward is added, making £14,918, and after paying the cumulative preference dividend, a dividend of 2½ per cent. (against 5 per cent.) is to be paid on the ordinary shares and £7,323 is carried forward. The report mentions that the directors' fees have been reduced to £300, and those directors concerned have waived all claim to an unappropriated balance for past years. Difficult trading conditions were again experienced, and the general industrial depression caused a serious diminution of orders during the latter part of the year; keen competition in the industry itself continued throughout the period. The death is recorded of Mr. Alfred Tongue, an original director of the company and chairman from 1923 to 1929. Meeting: March 24th.

British Insulated Cables, Ltd.

The report for the year ended December 31st last shows a profit of £576,593 (as compared with £685,980 in 1929); to this is added £280,807 brought forward, making £857,400. After meeting directors' fees, debenture interest, preference and interim ordinary dividends, &c., transferring £120,000 (£198,333) to reserve, and allocating £100,000 to depreciation, there remains a balance of £445,984. A final ordinary dividend of 10 per cent. is recommended, again making 15 per cent. for the year, and £279,318 is carried forward. Having regard to the conditions of trade in general, the directors consider the results satisfactory. The report records the death of the chairman, Mr. Dane Sinclair, who joined the company in 1902. Sir Alexander Roger is now chairman, while Mr. J. Ferguson is vice-chairman. Meeting: To-day (Friday).

West Gloucestershire Power Co.

The report for 1930 shows a revenue of £105,251, an increase of £24,943 as compared with the preceding year. The balance on revenue account was £16,578, an increase of approximately 46 per cent., and this has been applied in the reduction of the deficit brought forward to £12,711. The electrical energy sold increased by 10,503,553 kWh to 23,767,298 kWh.

Isle of Thanet Electric Supply Co., Ltd.

Presiding at the annual meeting on March 11th, Mr. A. R. Monks (chairman), in the course of his speech, said that, as compared with the previous year, the total revenue showed a decrease of £1,421, as, owing to competition and the trade depression, the tramway revenue showed a substantial reduction. The lighting, heating and power revenue was satisfactory. They had been pressed by certain consumers and the local authorities at Margate and Broadstairs to reduce their tariffs. The matter was under consideration, and they hoped to come to an arrangement which would be satisfactory to all parties. The report and accounts were adopted.

Elgin Electric Supply Co., Ltd.

Lord Provost Wittet, who presided at the annual meeting on March 12th, stated the increase in the company's business in the past year was 40 per cent. There was a net balance of £2,463, and the dividend was 6 per cent.

International Automatic Telephone Co., Ltd.

Out of the profit of £134,024 for 1930 (against £135,849) the company is again paying a final ordinary dividend of 6¼ per cent. (making 10 per cent. for the year), plus a bonus of 2½ per cent., less tax. The allocation to reserve is again £10,000, and the balance carried forward is increased from £82,578 to £92,980.

Automatic Telephone Manufacturing Co., Ltd.

The report for the year ended December 31st last shows a profit of £100,159. A final dividend of 6¼ per cent. and a bonus of 2½ per cent., less tax, are to be paid, making the distribution for 1930 12½ per cent., as in the preceding year. The allocation to reserve is £20,000, and £120,205 is carried forward, as against £118,285 brought in.

Croydon Cable Works, Ltd.

The accounts for 1930 show a trading profit, with interest on deposit, &c., of £9,271 (against £10,457), and after deducting debenture interest, &c., there is a balance of £2,557, to which is added £4,018 brought in, making £6,575 to be carried forward.

Globe Telegraph & Trust Co., Ltd.

A quarterly dividend of 3s. 6d. per share net has been declared on the ordinary shares, payable March 31st.

Waste Heat & Gas Electrical Generating Stations, Ltd.

A final dividend of 5¼ per cent. has been declared, making a total dividend of 8 per cent. for the year.

Vickers, Ltd.

It is proposed to pay a dividend of 8 per cent., less tax, on the ordinary shares for the past year (same).

Pinchin, Johnson & Co., Ltd.

The net profit for 1930 was £391,323, as compared with £462,349 in the previous year. A final dividend of 12½ per cent. is recommended on the ordinary shares, making 22½ per cent. for the year. The total dividend for 1929 was 30 per cent., but the capital has since been increased.

Erinoid, Ltd.

The directors recommend a dividend of 5 per cent. for the eleven months to July 31st, 1930. The accounts were issued in October last, but no dividend was then recommended.

British Aluminium Co., Ltd.

A final dividend is recommended on the ordinary shares of 6 per cent., making 10 per cent. for the year (same).

Stocks and Shares.

TUESDAY EVENING.

BUSINESS in the Stock Exchange markets shows a moderate amount of activity, though it must be admitted that the animation is very spasmodic. The strength of gilt-edged securities is once more an outstanding feature. This is one of the indications which many people are watching in order to gain some idea of the turning of the tide of business; it is argued that, as soon as industry revives, capital will be required in order to cope with increased orders, and that this money will be found first by sales of gilt-edged securities, which bring in no more than 4½ to 5 per cent. on the money. At present, no particular sign is patent as to sales of purely investment securities, nor is there much hopefulness to be found in the returns of the Home railway companies, or of the Cables and Wireless combine, two other standards by which the trade of the country can be measured. There is no doubt, however, as to the better feeling which prevails, and an occasional cheering dividend announcement, such as that, for example, by Vickers, serves to stimulate the impression that business is gradually becoming better. Vickers are repeating the previously-paid 8 per cent. dividend, and on this the 6s. 8d. shares strengthened to 8s.

Electricity Supply Shares.

Home electricity shares continue to improve. Rises have lifted the prices of Bromptons, Kensingtons, and London Electrics, while in the Provincial group there are advances in Clyde Valley and Lancashire Light & Power. Midland Corporation shares are a little better at 31s. North Metropolitans keep steady at 46s. In Egham & Staines, the recent advance is held at 41s. The South Metropolitan Electric Light & Power, paying the same dividend—9 per cent. for the year—as in the previous twelve months, had an available profit of £351,000. The Newcastle and District Electric Lighting Company increased its profits. The Folkestone Electricity Supply Company is again paying 10 per cent. for the year, tax free, on its ordinary and employés' co-partnership shares. The Newcastle-on-Tyne Electric Supply Company shows an increase of £37,400 in its profits, and the dividend is maintained at 6 per cent.

Home Railway Stocks.

The London Passenger Transport Bill was published at the end of last week, and it clears up certain of the points which had previously been obscure. At the same time, no idea can yet be gleaned of the probable value which the existing stocks will command under the new scheme. The fact, however, that no changes have occurred in prices of Metropolitan or of District stock implies that the Stock Exchange market and the

investor in these issues are expecting that the new scheme will give holders much the same financial interest as they obtain at present. Underground Electric Railway shares are down 1s., at 22s. The chairman, Lord Ashfield, has stated that it will be his company's duty to assist the Minister's scheme, and to help him at every point, provided that the plan makes for continued progress, and also protection against impairment of the stockholders' security. The chairman of the Metropolitan Railway, who spoke very strongly against the Bill at the company's meeting last month, does not mince his words in commenting upon the latest particulars. Until further official particulars are published, it is impossible to gain any definite idea as to what the value of the existing stocks can be. London United Tramways 4 per cent. debenture has gained 2 points at 62½, while London & Suburban Traction preference remain at half-a-guinea.

Cables and Wireless.

The tendency of the Cables & Wireless market is towards lower prices. The preference has fallen 3½ to 69½. Nothing has developed in connection with the rumoured fusion between the Cables & Wireless and the International Telephone and Telegraph Corporation, and the report, having done duty for a fortnight, is allowed to sink quietly out of sight. The International Telephone & Telegraph Corporation announces that its net income for 1930 was equivalent to 2.07 dollars per share, compared with 3.03 dollars per share in 1929. The company is continuing, however, to pay the regular quarterly dividend of 50 cents per share, and the price of the shares is quoted at 38. American Telephone & Telegraph went back to 202½ after being 205. Marconi Marines have improved to £2, on the considerations of yield and earnings that have been mentioned here from time to time. Automatic Telephone shares and International Automatics are unaffected in price by the publication of the company's accounts. Automatics are 37s. 6d., and Internationals 35s. The "B" deferred shares in the last-named company stand at 33s. Telephone Rentals are 3s., and Telephone Manufacturing (1929) 1s. 9d. Hall Telephone Accessories remain at 17s. The Globe Telegraph & Trust has declared a dividend of 3s. 6d. per share net on its £10 ordinary shares. This goes against 5s. net in the corresponding quarter last year, and the decrease is strictly in accordance with general expectations. The price of the shares has gone back £1 to 12½, after its somewhat dramatic rise in the past fortnight. Postal Telegraph & Cables bonds are dull, the 5 per cent. debenture stock at 80, and the 25-year collateral trust gold bonds at 75. The last business marked in the former was at 75 at the beginning of the year, and the others have not changed hands since the middle of last November, when business was recorded at 81.

Manufacturing and Equipment.

No changes of any consequence have occurred in the list of shares in the manufacturing group. G.E.C. ordinary maintain their improvement at 46s. 3d. British Insulated Cables shares remain at 3½, unaffected by the report showing that the net profits for the year were £110,000 less than the bumper figures of 1929. The company is paying 15 per cent. dividend as before, and the profit, diminished though it be by comparison with that of the previous year, is equal to 29 per cent. on the ordinary capital. Hopes have been entertained for some time past that the company may make a fresh issue of shares at a price that will provide the holders of the existing shares with a bonus, but these expectations have been put on one side since the general trade depression set in. British Aluminiums are 2s. better at 31s. The iron and steel group continues firm, Babcock & Wilcox holding their gain at 51s. 3d. The rubber share market has fallen upon quiescence.

We are asked to explain how it is that the yield on shares in the Home Electricity Supply list does not correspond with the dividends which are being paid, and which appear in the fourth column of the weekly price lists. The explanation has been set out here on various former occasions, but possibly it may be of use to repeat that, in view of the fact that most of the London companies will move on to a 7 per cent. standard dividend after the end of 1931, the austere course has been adopted of working out the yields in our lists on the basis of the 7 per cent. that will become, in all probability, the general rate. It is thought that the companies may be able to declare a little more than 7 per cent., in accordance with the provisions of the sliding-scale as applied to dividends and prices to consumers, but, so far as is known at present, the companies will pay 7 per cent. dividends after the end of 1931. Of the companies which are not included in this arrangement, County of London and Metropolitans are two of the exceptions. It is possible, moreover, that the City of London and the Charing Cross companies may not be entirely bound by the provisions that make 7 per cent. the maximum dividend. The current dividends are in every case higher than the 7 per cent. standard rate. The prospective investor, however, looking at the industry from the point of view of employment of capital, must bear in mind the reduction which will be made.

Dollar Stocks.

Mexican Light & Power common shares are 4 points higher at 52½, and the company's second preference show 5/16 improvement at 3½. Power Corporation of Canada are firm at 61; so are Shawinigans at the same price, and Pennsylvania Water and Power at 67½. A mild boomlet in Brazilian Government bonds has had no influence upon Brazilian utility issues.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1928.	1929.	Price March 17 1931.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	3	—	5 0 0
Brompton Ordinary	1	8½	8½	28/6	+6d.	4 18 3
Central Electricity 4½% Deb. ...	Stock	—	—	94½	—	4 15 3
Charing Cross Ordinary	1	8½	8½	29/6	—	4 15 0
Chelsea	1	8½	8½	28/-	—	5 0 0
City of London	1	10	10	36/3	—	5 10 3
Clyde Valley	1	8	8	34/6	+9d.	4 12 9
County of London	1	7	10	42/9	—	4 2 0
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	47/6	—	4 12 7
Kensington Ordinary	1	8	8	29/6	+6d.	4 15 0
Lancs. Light and Power	1	7½	7	28/6	+6d.	5 19 2
London & Home Counties 4½% Deb.	Stock	—	—	94½	—	4 15 3
London Electric	1	8½	9	33/6	+6d.	5 7 6
Metropolitan	1	9	10	41/3	—	4 17 1
Midland Counties	1	6½	7	28/-xd	+ d.	5 0 0
Mid. Elec. Power	1	15	8	31/8	—	5 2 5
Newcastle-on-Tyne Ordinary ...	1	6	6	23/3	—	5 6 8
do. 7% Pref.	1	7	7	27/6	—	5 1 10
Notting Hill 6% Pref.	10	6	6	11½	—	5 6 8
North Met. Elec. 6% Pref. ...	1	6	6	24/-	—	5 0 0
St. James' and Pall Mall	1	8	8	28/6xd	—	4 18 3
Scottish Power	1	8	8	20/6	—	5 8 6
South London	1	8½	8½	28/-	—	5 0 0
Urban Ordinary	1	7	7	27/6	—1/3	5 1 10
Westminster Ordinary	1	8½	8½	28/6xd	—	4 18 3
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	25/6	—	5 17 8
Yorkshire Elec.	1	8		32/6	—	4 18 6

Home Rails.

Central London Ord. Assented ...	Stock	4	4	78xd	—	5 2 7
Metropolitan	,,	3½	4	56½xd	—	6 4 0
do. District	,	4	5	73½xd	—	6 16 0
Underground Electric	£1	7	8	22/-xd	—1/-	7 2 3

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	103½	—	5 16
do. Def.	,,	1½	1½	25½	—	5 16 6
Automatic Telephone	1	10	12½	37/6	—	6 13 4
Cables & Wireless 5½% Pref. ...	Stock	—	5½	69½	—3½	7 18 0
do. A 7½% Ord.	,,	—	—	24	—1	... ...
do. B Ord.	,,	—	—	12½	—½	... ...
Globe Tel. and T. Ord.	10	10	10	12½	—1	... ...
do. do. Pref.	10	6	6	10½	—½	5 14 3
Great Northern Tel.	10	20	20	29½	+½	6 14 5
Marconi-Marine	1	12½	15	40/-	+6d.	7 10 0
Oriental Telephone Ord.	1	12	12	28	—	*5 1 9

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	5½	1½	+½	... ...
do. do. 2nd Pref. ...	5	6	6	16/-	—	... ...
do. do. 5% Deb. ...	Stock	5	5	42½	—	11 18 3
British Electric Traction Def. Ord.	,,	5	5	1380	—	... ...
do. do. Pref. Ord.	,,		8	131½	—	6 1 6
Brazil Traction	100	7	8	23	—	... ...
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	97½	—	5 2 7
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/6	—	... ...
London United Tram Deb. ...	Stock	4	4	63½	+2	6 6 0
Mexico Trams, 5% Bonds ...	—	5	5	49½	—	10 2 0
Mexican Light Common	100	Nil	Nil	52½	+4	... ...
do. 7% Pref.	100	7	7	67½	—	10 7 4
do. 1st Bonds	—	5	5	78	—	6 8 0
Victoria Falls Ord.	1	15	15	57/6	—	5 4 5
Yorkshire (West Riding)		Nil	Nil	5/6	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	6	23/-	—	5 4 4
Babcock & Wilcox	1	13	15	51/3	—	*5 17 0
British Aluminium Ord.	1	10	10	31/-	+2/-	6 9 0
British Insulated Ord.	1	15	15	3½	—	4 16 0
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	3	—	5 0 0
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	—	30	22/-	—	6 10 0
do. 8% Pref.	1	8	8	32/-	—	5 14 0
Edison-Swan 1st Pref.	1	7½	7½	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	94½	—	5 5 10
Electric Construction	1	5½	5	11/9	—	8 10 2
Enfield Cable Ord.	1	20	25	4½	—	5 14 2
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	3	Nil	6/3	—	... ...
Ferranti Pref.	1	7	7	21/6	—	6 10 4
G.E.C. Pref.	1	6½	6½	25/6	—	5 2 0
do. Ord.	1	10	14	46/3	—	6 1 0
Henley	1	25	30	5½	—	5 6 0
do. 4½% Pref.	5	4½	4½	4½xd	—	5 6 0
India-Rubber	1	Nil	Nil	5/-	—	... ...
Johnson & Phillips	1	10	10	36/9	—	5 9 10
Siemens Ord.	1	7½	7½	1½	—	7 1 3
Telegraph Construction	12	10	10	15½	—	*7 5 5

*Dividends paid free of Income Tax.

Our Foreign Electrical Trade.

Electrical Exports and Imports during February.

A VERY substantial decline in trade—both imports and exports—is revealed by the Board of Trade returns for February, and in this decline electrical goods were affected to a greater extent than many other classes.

The electrical export total for the month reached the lowest level since June, 1924, and was even below the figure of £1,158,236 recorded for the month of the general strike—May, 1926. There was a decline as compared with the January total, which itself was a low figure, but that was partly due to the fact that February is a shorter month. One very variable factor which contributed to the decline was submarine telegraph and telephone cable exports which were £34,600 lower in value than in January. Unenumerated goods fell by about 26 per cent. in value, and batteries and accumulators to a similar extent. Electrical machinery exports were only about 4 per cent. lower on the whole. There was a slight improvement in exports of insulated wires and cables. In comparison with February, 1930, the export total showed a decline of 32 per cent. This was attributable mainly to the shipments of electrical machinery falling by 30 per cent. and to cable and wire exports being 48 per cent. lower. There were also very considerable decreases in the cases of unenumerated goods, batteries and accumulators, and submarine telegraph and telephone cable. So far this year there has been a decline of £1,048,567 in exports—almost equal to a month's shipments. This can be explained partly by the fall in prices during the past twelve months, but the causes of the major portion of the falling-off must be looked for elsewhere.

Turning now to the import figures, the decline in the February total, as compared with that of the preceding month, was not very great, and can be accounted for by the difference in the length of the respective periods. The greatest decrease (£24,186) occurred in the case of telegraph and telephone apparatus, while electrical machinery and meters and instruments together contributed about £22,000 to the decline. There were small increases in imports of batteries and accumulators, carbons, unenumerated goods and arc lamps. As compared with the February, 1930, figures, however, the decline was proportionally much greater than that in exports, being equivalent to over 36 per cent. It will be seen that the greater part of the decrease in February was due to a fall of £195,592 in imports of meters and instruments. It is not possible to ascertain from the returns to what this decline is attributable. The Board of Trade Committee under the Merchandise Marks Act, 1926, has recommended that imported meters should be marked to indicate their foreign origin, but as no Order-in-Council has yet been made to give effect to the recommendation, the decline in this item cannot be put down to this cause. Possibly the marking orders which have been made in respect of cables and lamps may have had some influence on imports of these items which showed substantial falls during February. In contrast to the general decrease, telegraph and telephone apparatus imports were £13,270 higher than in February last year. During 1930 re-exports were on an abnormally high scale and the reaction which has set in is consequently not surprising.

Electrical Machinery Exports.

Destination.	Quantities Feb., 1930. Tons.	Quantities Feb., 1931. Tons	Quantities Inc. or dec. Tons.	Values Feb., 1930. £	Values Feb., 1931. £	Values Inc. or dec. £
Europe	467	828	+361	110,109	115,115	+ 5,006
Japan	27	27	—	6,963	3,392	− 3,571
South America ...	422	359	− 63	66,385	58,117	− 8,268
South Africa ...	327	239	− 88	44,256	31,432	−12,824
British India ...	757	326	−431	121,097	58,618	−62,479
Australia	590	95	−495	90,481	18,012	−72,469
New Zealand ...	230	83	−147	32,673	15,864	−16,809
Canada	133	212	+ 79	16,009	24,981	+ 8,972
Other countries ...	684	570	−114	96,721	81,067	−15,654
Total ...	3,637	2,739	−898	£584,694	£406,598	−£178,096

The inset table gives some particulars of the distribution of our electrical machinery exports during February, and compares the figures with those for the corresponding month of last year. As we have already stated, the total was £178,096 down, but it is a remarkable fact that in the face of this general decline European countries and Canada were credited with more than in February, 1930. The figures given for Australia and India are very disappointing. In the case of Australia retrenchment, coupled with high Customs duties, are mainly responsible for the serious decrease (80 per cent.). The halving of exports to India and New Zealand is no doubt due to the general world depression. There does not appear to have been a considerable fall in the value of exported electrical machinery; the value per ton decreased from about £160 to £150 during the year, *i.e.*, only about 6 per cent.

	Exports. Electrical exports for Feb., 1931.	Exports. Inc. or dec. as compared with Jan., 1931.	Exports. Inc. or dec. as compared with Feb., 1930.	Imports. Electrical imports or Feb., 1931.	Imports. Inc. or dec. as compared with Jan., 1931.	Imports. Inc. or dec. as compared with Feb., 1930.	Re-Exports. Electrical re-exports for Feb., 1931.	Re-Exports. Inc. or dec. as compared with Jan., 1931.	Re-Exports. Inc. or dec as compared with Feb., 1930.
Electrical goods and apparatus (unenumerated)	£147,844	−£51,980	−£96,371	£116,165	+ £523	− £8,077	£9 200	+ £1,262	− £1,277
Insulated wires and cables ...	174,200	+ 4,233	− 158,943	57,721	− 3.231	− 37,397	1,222	− 5,770	+ 546
Glow lamps	30,049	− 10,644	− 11.993	25,136	− 7.906	− 10,904	424	− 359	− 1,069
Arc lamps and parts	1,978	+ 1,222	− 2,844	4,425	+ 157	+ 1,185	—	— 99	− 2
Batteries and accumulators ...	50,224	− 12,673	− 36,384	45.144	+ 3 631	− 2,754	429	+ 181	− 18,500
Meters and instruments ...	29,298	− 3,574	+ 2,703	27,841	− 10,619	− 195,592	988	− 333	+ 199
Carbons	492	− 152	+ 284	11,154	+ 1,705	− 4,407	81	− 136	− 729
Switchboards (not telegraph or telephone)	4.179	− 2,367	− 5,778	73	− 326	− 51	—	− 16	− 10
Electrical Machinery—									
Electrical machinery (unenumerated)	247,424	− 21.381	− 119.473	109,807	− 11,701	− 43,095	10,615	− 6,772	− 582
Railway and tramway motors	14,039	− 3,619	− 16,958	—	—	—	—	—	—
Other motors and generators...	145,135	+ 7,308	− 41,665	—	—	—	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	56,814	− 15,856	− 308	2,251	− 766	− 1,285	1,051	+ 985	+ 1,051
Submarine telegraph and telephone cable	2,876	− 34,609	− 44,259	—	—	—	—	− 250	—
Telegraph and telephone apparatus	198,176	− 2.300	− 20,647	103,104	− 24,186	+ 13.270	8,739	+ 1,626	−60,338
Totals...	£1,102,728	−£146,392	− £552,636	£506,821	− £52,719	−£289,107	£32,749	− £9,681	−£80,711
Decrease for first two months of the year	... ...		Exports £1,048,567			Imports £651,795			Re-Exports £85,359

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes.

Flexible Cables with Strain Cords.

There is much to commend the use of c.t.s. flexible cables provided with strain cords, as are now being supplied by W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1, under patent No. 247401. The strain-bearing cords strengthen the flexible, and, as they are laid up in the scores, filling the interstices, a smoother and more circular finish to the cable is obtained. The cables are supplied in classes S.R.2, S.R.3, S.R.4, and S.R.P.2, the last named being a pendant cord.

C.T.S. Cable with Strain Cords.

Improved Traction Motors.

Two new designs of light-weight electric motors for trolley-'buses have been developed by Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester. They constitute a new record in light-weight for motors for traction purposes, the weight being only 930 lb. for a 75-h.p. continuous rating motor, 1,460 r.p.m. The overall dimension from top to bottom of the motor is only 16 in. It is stated that the reduction in weight has not been secured by any sacrifice of mechanical strength. Some contribution to weight reduction has been obtained by the use of light alloys for the end brackets and other parts, but it is chiefly due to efficient design, so as to ensure the best possible use of available materials.

Thermostatic Metal.

Messrs. Wolf & Morgan, Ltd., 66, Victoria Street, S.W.1, have recently introduced in this country "Chase" thermostatic metal (bi-metal) for working temperatures of from 325 to 1,200 deg. F. The substance is a fabrication of two metals having widely different coefficients of thermal expansion, and when subjected to a temperature rise it bends or deflects. The fabrication process results in high sensitivity combined with accuracy and reliability. The material lends itself for use as flat strip, "hair pin" shape, or in disk or coiled-spring form. The coiled spring is especially adapted to the dial type of device, while the "hair pin" shape makes it possible to secure maximum movement in a limited amount of space In order to provide as great sensitivity as possible for a definite working range several types of thermostatic metal are available. High or low temperature applications can best be met by selecting a type that gives the proper sensitivity at the desired working temperature. As the laws governing deflection are simple physical laws, it is possible to work out from curves the approximate thickness and length of strip desired for a given temperature range. The deflection varies as the square of the length. It is possible in some cases to use strips laminated so as to increase the strength. The metal is received in lengths of up to 8 ft. The standard width is 6 in. for strips 0.030 in. thick and above; below 0.030 in. thick the standard width is 3 in. A width should be selected that is a multiple of the standard width, so as to avoid waste in cutting. Standard sizes run from 0.015 in. to 0.100 in. thick in steps of 0.005 in. increase.

A Luminous Indicator System.

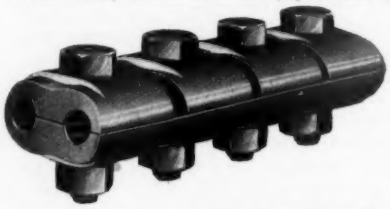
To meet modern standards of promptitude and reliability the "Magnet" luminous service indicator system has been recently produced by the General Electric Co., Ltd., Magnet House, Kingsway, W.C.2. The main feature of the system is a relay switch which, when electrically operated by means of a call-push, completes the circuits of various indicating lamps. When the call-push circuit is opened these indicating lamp circuits remain closed, since the contacts of the relay switch can only be separated by pressure on the reset push which is itself an integral part of the relay switch. This switch may be supplied in combination with an indicator lamp in units of one, two, or three ways for individual calls, distinctive colours being employed for the different ways. The combined lamp and relay switch in its simplest form has a plain metal front plate, but the latter may be made in any style, finish, or material. In an hotel a one-, two- or three-way bell push is provided in each visitor's room, and the pressing of one of the buttons illuminates a lamp in the group indicator immediately outside the room door, in the lamp and relay switch at the end of the corridor or other convenient position, and also in a section indicator placed in the attendants' servery. At the same time an audible signal is given in the servery by means of a bakelite bell or buzzer. Should the maid be temporarily absent from the servery she need not return there, as on hearing the bell or buzzer she will glance at the group indicators in the corridor and at once see in which direction her presence is required. Proceeding to the particular group indicator she will then see the coloured lamp on the relay switch indicating the particular room calling. Before entering the room she will press the coloured button of the relay switch and thereby extinguish the lamps relating to the particular call. The system can be supplied for d.c. or a.c. supplies at 24 V, utilising an accumulator for d.c. and a transformer for a.c.

A Furnace Control System.

In a recent issue of the "Journal du Four Electrique et des Industries Electrochimiques," M. Paul Pergeron describes a new method of control which has been applied to two new 4,000-kW electric furnaces at the electro-chemical works at Langerbrugge, Belgium. The electrodes are fixed, the current intensity being varied at the terminals by means of supplementary connections to the transformer and commutator which can be adjusted while the furnace is at work. Among the advantages claimed for the new arrangement are that the furnace works more regularly, a reduction in electrode wear of 30 per cent., a reduction in the power capacity of the servo motors and in the weight of the electrical controls, and the possibility of remote control. As against these advantages the author points out that the method necessitates the employment of somewhat delicate connections, although these are now generally of reliable construction. Each of the two furnaces at Langerbrugge is supplied with power by a single-phase transformer fitted with a connection device with 56 different positions, enabling the intensity of the current to be progressively adjusted. The connecting devices are operated by "Cuenod" regulators which enable the current to be kept constant within a margin of 2 per cent. Small rheostats are also provided, by means of which it is possible to vary the capacity of the furnaces almost instantly between 2,600 and 8,000 kW.

Overhead-line Connectors.

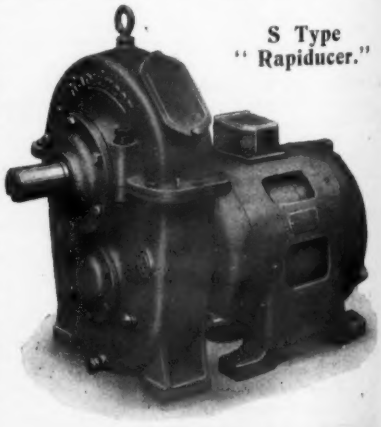
To meet the growing demand for fittings for use with overhead lines, the Electrical Equipment & Carbon Co., Ltd., 107-111, New Oxford Street, W.C.1, has just put on the market a very wide range of tension and non-tension joints, line clamps, tee pieces, &c., and it is claimed that by using these modern appliances, many of which have been made to overcome difficulties experienced by the linesman, a considerable amount of both time and labour are saved. The top illustration shows an aluminium parallel clamp which can be supplied fitted with three or four bolts. The latest fitting introduced by this firm is a clamp for tapping copper conductor from an aluminium line. The body of the clamp is made of aluminium, and the point of contact between this and the tinned copper is protected by insulating compound.



Aluminium Parallel Clamp; Aluminium to Copper "Tee Off."

A Low-speed Driving Unit.

To enable it to present a highly efficient and compact power transmission unit, the Power Plant Co., Ltd., West Drayton, Middlesex, has produced the "Rapiducer," a combined high-speed electric motor and double helical gears. The latter are generated by a process which produces continuous teeth, and are carried in anti-friction ball and roller motor is rigidly bearings. The secured to the gear casing, perfect alignment being obtained by a machined spigot. The apparatus is supplied complete in a series of sizes with transmitting capacities of from 1 to 100 h.p., and it is made in two types, S, for a maximum reduction ratio of 6 to 1, and D for a 25 to 1 ratio. The S type has an overall full-load efficiency of 98½ per cent. and the D type of 97 per cent. These efficiencies apply at any ratio up to the maximum of 25 to 1. In standard models, squirrel-cage, slip-ring and d.c. motors of the screen protected type are provided. Lubrication is automatic and is provided by the lower gear dipping in oil. An inspection cover permits occasional examination of the gears.



S Type "Rapiducer."

The Societies and their Doings.

This week's subjects of debate are metal cleaning and hardening, the physicist-engineer, mercury-arc rectifiers, photo-telegraphy, sound reproduction, an E.D.A. conference, and a sesquicentenary.

Electroplaters Discuss Modern Metal Cleaning.

An interesting paper on modern developments in metal cleaning, which has assumed considerable importance of late, was recently read before the Electroplaters' and Depositors' Technical Society by Messrs. L. Wright and F. Taylor. It indicates that the trend of technical thought on the subject has undergone much change in recent years. The application of mass-production methods to cleaning problems has resulted in the production of special washing machines, tumbling barrels, automatic tanks, steam sprays, air sprays, and equipment incorporating mechanical brushing. However, the tank, either with or without electrical connections, remains the most generally used means of metal cleaning. If there is not a large volume of cleaning solution, it will be difficult to maintain a steady temperature and the dirt, instead of being held in suspension, will be redeposited on the work. Gas and electrical heating, the latter by means of immersion heaters, find ready application and the closed steam coil provides a good method.

Electric cleaning, which is rapidly coming into general use, adds to chemical cleaning the advantages of mechanical cleaning in the one operation. The passage of direct current through a cleaning solution liberates oxygen at the anode and hydrogen at the cathode. The hydrogen forces the dirt particles from the metal to be cleaned and the lightness of the gas, which causes it to rise rapidly to the surface of the solution, tends to carry away the dirt into the bulk of the solution, where it is readily emulsified and suspended. With electric cleaning it is customary to make the tank the anode and hang the work on the cathode bar. It is advantageous to incorporate in the tank a steam coil and overflow dam and to electrically insulate the steam coil at the inlet and outlet. The potential across the tank should be of the order of six volts and the cathodic current density from 30 to 40 amperes per sq. ft. There is a possibility of such metals as tin, lead, and zinc dissolving in the alkaline solution and, with accumulation, to plate out at the cathode. This difficulty can be overcome by inserting in the circuit a two-pole double-throw switch; after cleaning the article can be temporarily made the anode, which removes any adherent film. The accumulation of colloidal metal hydroxides, such as ferric hydroxide, can be avoided by the occasional use of supplementary steel anodes. The colloid particles, which are negatively charged, migrate to the positive pole and adhere to the surface. The supplementary anodes can be removed from the bath and scoured to remove the adherent hydroxide.

The modern heated and agitated electrical cleaner incorporates three actions, namely, chemical, physical, mechanical. Cleaners which use solvents cannot make the work chemically clean, and are not adapted for complete cleaning before electroplating. As the solvent evaporates from the surface it leaves behind a thin film of grease, the amount of which increases with continued use of the solvent.

The authors feel assured that the "cure all" chemical cleaner has not yet arrived. Scouring, mopping, and subsequent acid dips to remove the tarnish imparted by the cleaning action, are likely to remain in general use in the smaller type of plating shop.

The Hardening of Metals by Rotating Magnetic Fields.

A paper recently presented to the Royal Society describes the discovery by Mr. E. G. Herbert, B.Sc., M.I.Mech.E., of some remarkable changes that are produced in metals by the action of a rotating magnetic field. A striking feature (which is covered by patents) is the effect of the magnetic process on metals usually regarded as non-magnetic, brass and duralumin, for instance, an effect that is similar to that produced on steel. The phenomena are believed to be atomic in character, and their discovery should lead to an extension of knowledge of atomic physics.

The invention would seem to have practical applications of immediate importance. Articles of hard steel can be greatly increased in hardness, and the increase is found to persist at high temperatures. It is not yet possible to foresee what further practical results may follow from changes in the existing properties of metals, and, perhaps, new properties of an unknown character imparted to them by this process. It is by no means certain that the effects are confined to metals.

This discovery is the latest product of the "pendulum research." Many years have been devoted to investigations carried out with the Herbert pendulum hardness tester, which has proved to be very valuable as a research instrument and has revealed a whole series of phenomena not discoverable by other means.

In the direct line of the present results were the discoveries that the hardest steel can be "super-hardened" by rolling it with a spherical diamond, and that hard-steel parts of motor cars are super-hardened by the severe abrasion which occurs in service. This led to the invention of the "cloudburst" method of super-hardening steel by bombarding it with hard-steel balls, the discovery that super-hardened steel undergoes a further spontaneous hardening during several hours after the "cloudburst," and the invention of the magnetic process of rotating polarity to enhance this spontaneous increase of hardness. The discovery that a rotating magnetic field does not simply harden, but causes a sequence of hardness changes with time, led to its application to a variety of steels, both hard and soft, and to non-magnetic metals.

Presidential Prophecy at the North-Midland Centre of the I.E.E.

Remarking that during his year of office a president feels like a class of goods which, in another country, is described as being manufactured for accelerated obsolescence, and is apt towards the end of his term to become reflective on the trend of events, Mr. C. C. Paterson ventured to suggest, when addressing the North-Midland Centre of the Institution of Electrical Engineers at Leeds, that we should review our conception of what an electrical engineer is. If we do not, the practical physicist will ultimately set the pace and call the tune to which the engineer will have to dance. One may think he is already tending to do so, and isn't it even now beginning to be ignominious?

Instead of having the discoveries and products of electrical physics fostered in their early stages within our own membership, we look upon the men who do that work, or anyway they look upon themselves, as not being part and parcel of the Institution. A first honours physics degree is no qualification for membership, and we seem to be excluding in those early days of their careers, when they will join, the very men whose leavening influence can keep engineers from a narrow outlook. Who can prepare engineers for the things which are to come and make them realise in ample time that it is up to them to understand physical developments?

It is not sufficient that we welcome physicists to our meetings and invite papers from them. The president suggests we want them as members, to help to carry and to lead the Institution in practical matters, as they do in theoretical and intellectual activity; so that the physicist shall himself be given a sense of responsibility for the industry of the country and its welfare and not feel that (as practical engineers are in charge and do not take them in on equal terms) they have no responsibility.

Engineers were rather glad when the complete dominance of the professors in the Institution disappeared, but have they not lost something which in this, the next, generation can be regained by frankly taking into partnership that growing class of men who make physics their profession? For, remember, all branches of physics are the manifestations of the one science of electricity. To be more specific, nearly all the latest developments in practical electricity are based on the fact that when electricity leaves conductors to which all early engineering confined it and passes across a vacuous, or gaseous, space it can be handled and controlled with extraordinary facility. It is generally appreciated amongst engineers what enormous potentialities there are in this advance in electrical achievement; they would appreciate it much more if they had practical physicists really with them. The power valve has reached a size of 100 kW dissipation, the mercury-arc rectifier effectually replaces rotary convertors, and there is the enormous field of the thermionic valve; the electric lamp is tending to utilise for illumination purposes the ionisation of gas, which is another way of passing electricity through gas, and the photo-electric cell depends on the same type of phenomena; the possibilities of the hot-cathode vapour rectifier, which when it contains a grid is called a "Thyratron," can be seen in many applications in the heavy as well as in the light engineering fields, and lastly there is the conduction of electricity through the atmosphere, as it now travels on a small scale from one aerial to another.

Thus a large part of our new developments in electrical engineering involve in their practical every-day aspects the phenomena which come within the purview of the physicist. If applied electricity had begun with conduction in gases and vacua instead of in conductors, would the first qualification of the engineer not have been a degree in physics? Before very long we shall be faced with the practical outcomes of that relatively new type of phenomena, the behaviour of electricity in semi-conductors, and again it will be the physicist who will call the tune and the engineer will have to dance to it.

The Institution has never been backward in recognising tendencies of this kind. There comes a time, however, when some definite practical step has to be taken in order to adjust our organisation to the natural evolution of our art, and sooner or later it will take the form of the recognition by the Institution of a physics degree as a qualification for admission. What a valuable reciprocal effect that would have! Many men take an engineering degree now because it is the only means of entrance to the Institution, yet it is the "physicist engineer" we want: the man who takes his physics first and learns his engineering afterwards, either by degree or by experience. The president felt sure that not a few of his audience had been alarmed at his whole proposal, his object being, of course, to call attention to a tendency which he, personally, sees very plainly, so that it may not be overlooked in the evolution of the Institution.

I.E.E. Paper on Mercury-arc Rectifiers for Traction Sub-stations.

As a result of the special problems associated with the supply of direct current to traction systems, as distinct from lighting and power systems, automatic sub-station technique has advanced in two widely diverging directions. Whereas modern practice in America is characterised by the almost exclusive use of rotary convertors, European practice favours the adoption of mercury-arc rectifiers. The requirements peculiar to traction operation are outlined by Messrs. J. W. Rissik, B.Sc., A.M.I.E.E., and H. Rissik, B.Sc., Graduate I.E.E., in their Institution of Electrical Engineers' paper, which states that mercury-arc a.c. to d.c. rectification development has been such as to challenge the well-established and better-known forms of convertor. Its field of usefulness is intermediate between those of the low-voltage "Tungar" and high-voltage "Kenotron" valve rectifiers, *viz.*, in the region of roughly 100 to 20,000 volts. Above about 600 volts it is difficult to find any device, excepting perhaps the jet-wave rectifier (Elec. Rev., February 21st, 1930, p. 372), which is more efficient. Modern mercury-arc rectifiers are built in two forms: the glass-bulb type is constructed for outputs of from 15 to 450 amperes at from 50 to 1,800 volts, and the ironclad type is designed for from 500 to 3,000 volts and outputs up to 16,000 amperes at 500 volts. They are now also being used for the supply of high-voltage d.c. to wireless-telegraphy and broadcasting stations, voltages of 6,000 and 15,000 having been attained with glass-bulb and ironclad sets, respectively. Broadly speaking, then, the limiting unit outputs indicated by the present state of technical development are, respectively, 200 kW for the former and 8,000 kW for the latter.

TABLE I.—Total Installed Capacity.

Country.	Great Britain.	Germany.	America.
Number of undertakings, &c.	254	35	—
Rotary converting plant ...	2,263,600 kW	1,060,161 kW	4,424,000 kW
Rectifiers	92,288 kW	288,200 kW	177,775 kW
Total for all types of plants	2,355,888 kW	1,348,361 kW	4,601,775 kW

The extent to which a country is alive to the advantages of the method is the percentage of installed rectifier kW represented in the total installed kW of all types of converting plant existing in the electrified systems of that country's railways; for example:—

Great Britain, 1.15 per cent. (5,772 kW), six railways.
Germany, 88.92 per cent. (143,800 kW), one railway.

From Tables I and II it is concluded that in Great Britain, as compared with Germany, recognition of the fact that the rectifier (at any rate above 500 volts) is to be preferred to rotating converting machinery has been slow, which is also evidenced by the fact that the demand for rectifiers in Britain has been small, and that therefore (until very recently) no ironclad rectifiers have been manufactured in this country; *inter alia* it should be mentioned that one British firm has been manufacturing glass-bulb rectifiers for many years. A decided change in outlook has recently taken place, and British manufacturers have now been stimulated to take up the manufacture of heavy-duty rectifiers in competition with well-known Continental firms.

In Germany several firms have been manufacturing ironclad rectifiers for many years, and the extent to which this type of plant is employed has increased rapidly since 1918, a notable example being the electrification of the Berlin city and suburban railway system, the whole of which is supplied by rectifiers installed in 47 sub-stations, of which 31 are remote-controlled. A further interesting development is that the German Federal Railways have adopted the rectifier as the standard equipment for traction sub-stations.

The development of heavy-duty rectifiers in America has been comparatively slow, and those manufactured in America are designed according to the latest European practice. Approximately 177,775 kW of rectifiers is installed, the bulk of which is probably used for traction.

Mr. Roger T. Smith opened the discussion by noting the authors' omission of any mention of the Highfield "Transvertor" and high-voltage d.c. transmission. Remote control was simpler with rectifiers than rotary convertors; grid conditions would prevent the exclusive use of rectifiers, but they might be used under certain circumstances if main-line railway electrification were undertaken.

Mr. F. P. Whitaker said that all statistics had two meanings. Converting machines had been developed to a much greater degree in Britain than anywhere else in the world, and the German system had not been so stable as British rotary systems. When the rectifier had proved its reliability it would take its place in traction sub-stations. Some 22 complete sets of equipment were now being made in England for use on the London underground railways. Other factors besides efficiency must be considered; harmonic filters and line transposition would need to be used to avoid interference with communication circuits.

Dr. A. H. Railing mostly agreed with the authors' efficiency arguments, but not with their capital costs, especially at the lower voltages. Rectifiers were not particularly suitable for 440-V, 3-wire, d.c. distribution, which was far more extensive in Britain than on the Continent, and they would not stand long overloads like rotary machines.

TABLE II.—General Percentage Index.

Country.	Rectifiers.	Number of undertakings.
Great Britain	3.93 per cent. (92,288 kW)	254
Germany	24.44 per cent. (309,745 kW)	36
America	3.87 per cent. (177,775 kW)	—

Mr. A. L. Lunn felt sure that rectifiers would be more immune from disturbances on the high-voltage side than rotary convertors; they could also be re-started more quickly after a shut-down, and he favoured pre-heating, which could be done automatically. Time counted on a railway, sites were valuable, and noise should be avoided in residential districts. Next year the London underground railway would be using over 50,000 kW of rectifiers.

Mr. R. L. Morrison explained that there were many contributory causes of backfiring. Much water cooling was required to prevent rubber-seal deterioration; the mercury seal was the only reliable one and necessitated the use of the vacuum pumps for not more than a few minutes each month. Experiments in Switzerland had established the possibility of reversibility, and d.c. high-voltage transmission might thus be brought nearer than was generally realised.

Mr. J. C. Read favoured a.c. excitation and graphite anodes, even screens also, as all metal ones tended to melt. Concentric screens seemed to be wrong in that they restricted the exit of heat. The second plant erected by his company in London carried 2.25 full load on the second day after erection, and had continued to do so whenever required since.

Dr. C. C. Garrard asked for information relative to the behaviour of circuit breakers.

Mr. S. C. Bartholomew said that rectifiers were more prone to produce harmonics than rotary convertors, modern types of which caused no trouble, and would need careful attention if interference with communication circuits was to be avoided.

The Transmission of Still Pictures Demonstrated.

In a paper read by Mr. C. J. F. Tweed, Stud. I.E.E., before the London Students' Section of the I.E.E. last Friday, a portable picture system was described and an experimental model of the apparatus was used to show its practical utility. A message and a sketch of the connections of a wireless receiving set were inscribed in conducting ink by the chairman, Mr. S. B. Smith, on a chemically prepared form (about 9 in. by 5 in.); the ink penetrates a thin insulating surface and makes contact with a metallised under coating. A good facsimile was reproduced in about five minutes at a scanning speed of 14 in. per sec. The system has been designed to transmit rough sketches, maps, and MS. (but not halftone pictures) from an aeroplane to the ground or between two mobile ground stations; synchronism is independent, and the scanning stylus revolves, thus enabling the message to be observed during reception on the stationary drum. The iron stylus is a cathode and, having a tendency to wear, needs adjustment from time to time. Synchronism is obtained by means of a 1,000-cycle tuning fork at the transmitter and a stable valve oscillator at the receiver. Any variation in synchronism can be corrected immediately at the receiver, which is a matter of some importance since a variation of 1/10th of a cycle gives ¼ in. deviation from the vertical at the end of the picture. A brief account was given (with lantern illustrations) of a second system making use of optical scanning, a photo cell at the transmission end, and independent tuning fork synchronism. This system has been operated on a transatlantic short-wave radio circuit; the speed of transmission is limited owing to the presence of multiple signals.

The early part of the paper contains a useful summary of the fundamental principles involved in the majority of picture-transmission systems and the difficulties that arise in their application.

Mr. S. B. Smith was in the chair, and the delivery of the paper was followed by a discussion in which the undermentioned gentlemen took part: Messrs. Stanford, Page, Hughes, Stirling, Bridgewater, Watson, Hatch, Emerson, Goodhew, Owen, Smith, and MacMaster.

Royal Society of Arts Cantor Lecture on Sound Reproduction.

IN the first of his series of three Cantor Lectures which CAPT. A. G. D. WEST, M.A., B.Sc., is delivering at the ROYAL SOCIETY OF ARTS in London on sound recording and reproducing, the lecturer demonstrated the Berliner gramophone of 1891, the famous "Dog" model of 1898, the large horn popular in 1912, and the up-to-date automatic electrical reproducer. He then referred to some of the outstanding developments of recent times, and summed up the aims of the gramophone engineer in the word "naturalness." He next described why during the last few years it has been necessary to perfect methods of measurement so that the properties of music, speech, and noise can be fully analysed and examined, and demonstrated the importance of having a complete range of frequencies in reproducing speech and music by demonstrating what they sound like when certain frequency bands are removed from them. He described how the sound engineer is able to see and photograph echoes and reverberations in halls. Certain acoustic conditions for recording are of great value, and if they could be incorporated in every record would result in a much greater response on the part of the listener. Therefore, from a commercial point of view, echo, if handled properly, has a cash value. In this connection the Gramophone Co., Ltd. (H.M.V.), is commencing a new and exhaustive series of developments in an attempt to produce a "perfect" sound system which will fulfil the requirements of "naturalness" and "natural acoustic effect," so that even the most hardened critic will be "unable to tell the difference between the reproduction and the original."

"Do We Believe our Own Story?"

THIS was the arresting title of a talk by MR. R. W. KENNEDY at the sixth E.D.A. Conference of the session held on Friday last week. MR. A. C. CRAMB, director and secretary of E.D.A., was the chairman.

Mr. Kennedy based his talk on a recent statement by Mr. Herbert Morrison, Minister of Transport, regarding the number of people in the industry who did not employ electrical service and did not believe in its possibilities. Mr. Morrison had maintained that only extensive users of electrical service should be allowed to become members of electricity committees or directors of supply companies. Mr. Kennedy averred that there was plenty of direct evidence of the existence, among electrical men, of this wretched mental attitude. Within the past week or two we had heard the president of the British Electrical and Allied Industries Research Association assert in a widely-reported speech that good coffee could not be made in an electric percolator, or good toast with an electric toaster. Non-electrical people had been heard to say that certain electrical apparatus was "too expensive for words," often because they heard remarks made by people in the industry. Some of the stories going round the industry moved one to wonder whether we really wanted to sell our commodity to the public at all. On all hands, apparently, we were faced by most singular systems of charging, by most astonishing service charges, by point-blank refusals to lay mains unless really terrifying conditions and guarantees were humbly complied with, and by niggling restrictions and red-tape. No harm would be done—indeed, good might result—if some of these very diverting stories were told before internal assemblies of the trade and industry. Sheer apathy and lack of interest in electrical progress and in electrical affairs generally appeared to be the reason for the poor attendance at some E.D.A. conferences, yet those conference were of the greatest possible value. There was nothing approaching the social business meetings that were held in other industries, and a few hundreds a year spent in welding the electrical trade and industry into one optimistic and enthusiastic brotherhood would be money well and truly spent.

Another curious point was that electrical people were too modest. He suggested that the use of an "identification badge" would promote increased social contact and understanding between all members of the electrical family. He could call to mind only one organisation in the industry and one company that went out of their respective ways to make public and national confession of their electrical faith. By means of the London Lighting Bureau the lamp makers made a determined and persistent effort to spread the gospel of more and better lighting, and obviously believed their own story. But where was the cooking, heating, and water-heating bureau? Where was the "Central Bureau of Electrical Service"? It would be tremendously to the advantage of the industry if it had in its ranks a few more men possessing such outstanding vision and faith as Sir Hugo Hirst, who, recognising the need for electrical demonstration and electrical education, put forward years ago the idea of a central bureau or institution in which the whole electrical story might be told to the public in a worthy and comprehensive manner. A month or so ago, Sir Hugo Hirst repeated the suggestion, when he said that he looked forward to the time when three or four "demonstration palaces" might be set up in different parts of the country. But were we any nearer to such a practical achievement to-day than we were five or six years ago? After thirty years' observation of the industry the speaker suggested that electrical men exhibited little faith in their own story; that they were timid and hesitant, and distrustful and suspicious of one another.

In the subsequent discussion, MR. STEEL suggested that there might be better attendances at the conferences if some other evening than Friday was selected. He also urged that electrical people should boldly dispute many erroneous statements made by people outside the industry. MR. BAKER said that at East Ham every member of the staff of the Electricity Department was encouraged to use electricity in his home by being offered it at half the ordinary rates. MR. SELLY (St. Marylebone) suggested that the position was not so bad as Mr. Kennedy had made out, but admitted that the darkest building, from the point of view of exterior lighting, on the Embankment, was the Institution of Electrical Engineers, which ought to be floodlighted. Whilst the answer to the question put by the author was the increase in the uses of electricity made during the past ten years, we were only at the beginning as yet. When a suitable tariff was settled there would be enormous progress; indeed, there were signs of that already. MR. HAZELL contended that there was too great a tendency constantly to be decrying gas whereas it would be far better to be saying what electricity could do and was doing. MR. HAWKINS (E.L.M.A.) condemned the practice of granting members of electricity staffs electricity at cheaper rates than the normal. He said that the success of E.L.M.A. in attracting attention was due to the variety which was introduced into its demonstrations. Some modification of the usual E.D.A. conferences on novel lines would increase the attendances. MR. H. T. YOUNG said that the first task of E.L.M.A. was to teach those concerned with selling better lighting how to understand lighting better, and those engaged in the electricity supply industry generally needed education to understand better the many applications of electricity. Then they could go out and educate the public. Another speaker expressed the view that the public knew too little of what a unit of electricity would do, and more attention should be paid to this. He also complained of the "campaign" of certain newspapers against what was called dear electricity without due regard to circumstances. The next speaker suggested that electrical showroom attendants were frequently not sufficiently acquainted with what they had to sell, but MR. GILBERTSON (Walthamstow) repudiated this as a general charge, and said that the representatives of manufacturers were frequently unable to answer questions without referring to their head office. MR. P. P. WHEELWRIGHT pointed out that even the E.D.A. offices were not illuminated in a manner to draw attention to them. Supply authorities also should do a great deal more to attract the attention of the public to their premises by means of illuminated signs than was done at present. He also asked why the general public should not be invited to E.D.A. conferences. MR. V. W. DALE (Business Manager, E.D.A.) said that he had been strongly impressed by the enthusiasm of the many people in the industry whom he met. He doubted whether there was an industry in London which could get such well-attended conferences month by month as the E.D.A. Conferences. The CHAIRMAN said he would be pleased to receive suggestions from anybody with regard to the arrangement of the conferences next session. It was just possible that some lack of enthusiasm, as indicated by Mr. Kennedy, was due to the fact that for the most part supply companies could pay good dividends, and municipalities could pay money to the rates out of profits on their electricity undertakings. The grid scheme depended for its success upon a very large output of electricity.

MR. KENNEDY briefly replied to the discussion, and still maintained that in many respects the people in the industry did not, at the present time, believe their own story, although enormous improvement and development had taken place in recent years.

Manchester Literary and Philosophical Society's Sesquicentenary.

THE Manchester Literary and Philosophical Society, which is said to be second only to the Royal Society of London in age, celebrated its 150th anniversary on March 17th, 1931. Sir Joseph Thomson, a Manchester man and a student of Owens College, who has greatly enlarged our experimental knowledge of the structure of the Daltonian atom, was the honoured guest of the Society; he was presented with its Dalton Medal, and lectured in the Athenæum. In the course of the week of celebration the rooms of the Society at 36, George Street, were open for the inspection of a collection of MSS. and apparatus which principally relate to the work of Sturgeon, Dalton, and Joule. Dalton's simple, and even crude, apparatus and some personal relics gave a vivid idea of his personality.

Several of Joule's original pieces of apparatus illustrated his wonderful self-taught skill in designing instruments and two electric current meters based on the principle of balancing the magnetic force of the current against gravitational force were on view, besides an early electro-magnetic motor, which is, no doubt, the machine described in his first paper, written in 1838 and published in Sturgeon's "Annals of Electricity" (Vol. II, p. 122). An original form of dip circle for measuring the earth's magnetic inclination is referred to in Joule's "Collected Works" (Vol. I, April 6th, 1869). Joule is perhaps best remembered for his principle of the conservation of energy.

Reviews.

Mercury-arc Power Rectifiers. By O. K. Marti and H. Winograd. Pp. vii+473; figs. 230. London: McGraw-Hill Publishing Co., Ltd. Price 30s. net.

The appearance of another American book devoted exclusively to the mercury-arc rectifier indicates the growing attention that is being given to this apparatus in the U.S.A.

The opening chapter of the work is of a historical character, and describes the many problems which have had to be solved, not only in connection with main points of design, but also with such matters as the obtaining of effective seals, with steel-cased machines, with the maintenance of high vacua, and with the design of instruments for measuring the excessively small pressures existing in the vacuous enclosure. According to the authors, the total capacity of rectifiers now in use is of the order of one and a half million kilowatts.

Two simply and clearly written chapters of the book are devoted to the elementary principles underlying the action of mercury-arc rectifiers. Two further chapters are devoted to analytical theory, and deal with the current and voltage relationships of rectifier plant and with the wave form of rectified currents. In dealing with a relatively difficult subject such as this, the treatment is necessarily mathematical, but the maximum of simplicity appears to have been achieved by the authors.

A lengthy and masterly chapter deals with the very important subject of transformers for use with rectifier machines. Here again the authors have necessarily used some mathematical analysis in order to give a complete treatment of a somewhat complex subject. Due to the peculiarities of the a.c. supply to a valve type of rectifier, such as the mercury vapour machine, the internal conditions in an associated transformer are very different from those in a transformer supplying a rotary convertor, and these altered conditions give rise to special problems of design.

A large portion of the book is of a descriptive character, and deals with the construction, operation and testing of rectifiers, the design and layout of rectifier sub-stations, constructional details, and testing of rectifier units, and with the various associated auxiliary equipment and vacuum gauges. The chapter on operation is disappointingly brief, and maintenance engineers will doubtless feel that the authors might well have amplified this section, giving, perhaps, a little more information regarding the troubles which may be experienced.

A very useful chapter describes typical sub-station layouts, discusses in detail the possibilities of the automatic control of mercury-arc rectifiers, and describes the various protective devices which have been developed for these machines.

An important chapter deals with the control of the direct-current voltage of mercury-arc rectifiers, and the subject of interference with communication circuits is considered in some detail. Although the final chapter is concise and informative, many readers will doubtless wish that the authors could have dealt at greater length with the subject of testing.

An extensive bibliography comprising twenty pages, and a copious index, are included. The work, although mathematical in parts, is generally descriptive in character. It will thus appeal to the practical engineer, while the very able theoretical treatment of the various electrical phenomena peculiar to mercury arc rectifiers will render the work very acceptable to advanced students of electrical technology.

Radiations from Radio-active Substances. By Sir Ernest (now Lord) Rutherford, J. Chadwick, and C. D. Ellis. Pp. xi+588; figs. 140. London: Cambridge University Press. Price 25s. net.

Although there are several summaries of the literature of radio-activity, and at least one excellent elementary treatment of the subject, by Dr. Chadwick, there was, until the appearance of this book (which is so much altered from the 1912 *Radio-active Substances and their Radiations* that it is effectively a new one) no thoroughly up-to-date critical treatment of the properties of the nuclei of atoms and their radiations. Written as it is by three of the leading authorities, its value under these circumstances is difficult to overestimate. The general tone of the work is essentially physical, that is, the unravelling of the long series of radio-active transformations on the one hand, and technical and medical applications on the other, are only dealt with incidentally, and the main attention has been focussed on the radiations and their physical applications. Certain controversial matters are not argued, as opposite points of view have been adequately stated elsewhere. The senior author states in the preface that he has been mainly responsible for the chapters dealing with the α rays, Dr. Chadwick for those on the scattering of α and β particles by matter, and Dr. Ellis for the account of the β and γ rays, but this must not be taken to indicate that there is at any place a hiatus in the text.

There are four matters which appeal as being of particular interest; these are the artificial disintegration of the light elements, the new quantum theory of the emission of particles from nuclei, the spectra of β and γ rays, and the question of the radio-activity of elements other than those comprised in the well-established series of high atomic number. With artificial disintegration—all elements from boron to potassium can be disintegrated by the bombardment of α particles, with the two exceptions of oxygen and carbon—one feels that there is, in common with Dr. Aston's work upon isotopes, a sound experimental line of approach to the problem of the interrelation of the ordinary elements.

One very pleasing feature is the set of twelve plates. Eight of these contain reproductions of the trails of particles obtained with the Wilson cloud chamber, and provide a most beautiful and convincing demonstration of the reality of the particles; the other points illustrated are the spectra of α, β, and γ rays, the tracks of α particles in a photographic plate, and pleochroic haloes. The diagrams in the text are also very clear. To the serious student of radio-activity the book is, naturally, indispensable; to the ordinary reader of this journal, without specialised knowledge of atomic physics, it can still be recommended as a lucid account of a subject of absorbing interest.

The Cable and Wireless Communications of the World. By F. J. Brown, C.B., C.B.E., M.A., B.Sc. (Lond.). Second edition, revised. Pp. xi+153; figs. 21. London: Sir Isaac Pitman & Sons, Ltd. Price 7s. 6d. net.

The first edition of this book, which was published three years ago, being exhausted, the author has taken the opportunity of a reprint, to revise the work as a whole, and to rewrite portions of it so as to bring it up-to-date.

The last few years have produced many developments in world communications. Important combinations have taken place all over the world between companies interested in telegraphs, cables, and wireless, and on the technical side we have witnessed the birth of short-wave wireless communication by telegraphy and telephony over great distances, the growth of facsimile transmission both by line and wireless, the solving of the problem of long-distance submarine telephone communication, and the demonstration of the practicability of television, when further developed, for communication services.

Mr. Brown, in this new edition, deals with all these developments, with the exception of television which has not yet, of course, reached the commercial stage. His only mention, however, of long-range submarine telephony is to note the project of laying a cable between this country and America, and to add the words, "no cable of this kind has hitherto been laid." We should have welcomed further information on this important subject. He explains the change of policy which has taken place in this country, since his book was published three years ago, as regards the control of communications, and mentions the similar movements towards merger companies which have been started in the United States and other countries.

It is interesting to note that Mr. Brown, who is in an exceptionally favourable position for forming an opinion, sums up a comparison between cables and wireless in the following words: "the loaded cable—whatever may be the position as regards the older type of cable—seems to possess indisputable economic advantages as compared with any form of wireless telegraphy, even including the beam."

Mr. Brown suggests interesting possibilities for the development of facsimile transmission, *viz.*, large users having private wires to a sort of cable exchange where they will be put through to similar subscribers, the messages being sent by means of typewriters, and the charges being made on a time basis.

The book gives an excellent and authoritative summary of the history of the cable and wireless communications of the world, the manufacture and maintenance of cables, the developments of wireless communication, the control and working of cable and wireless systems, the wider commercial aspects of broadcasting, and the financial aspects of cable and wireless communication.

A Guide to the Public Works Facilities Act, 1930. By F. N. Keen, LL.B., and H. R. Askew, B.Sc.(Eng.), Barristers-at-Law. Pp. 176. London: Stevens & Sons, Ltd. Price 10s. net.

The purposes of the Act with which this book deals are to provide a short cut for schemes designed to provide employment and to facilitate the compulsory acquisition of land for a variety of purposes. In the introduction the authors outline the existing cumbersome procedure which public authorities are forced to follow to obtain powers to carry out works, and the new methods provided by the Bill are contrasted with this. Next, the procedure under the Act is detailed, and in a miscellaneous section the subject of electricity Special Orders is treated. The Act provides that the Minister of Transport can confirm an Order made by the Electricity Commissioners at once if he is satisfied that certain conditions have been fulfilled. By this means a great deal of time may be saved. The book should prove of considerable assistance to local authorities and public utility undertakers.

How to Make the British Railways Pay: an Economic Survey. By M. F. Farrar. Pp. 28+82. London: Sir Isaac Pitman & Sons, Ltd. Price 3s. 6d. net.

In this book the author, who is an electrical engineer, expresses the view that railway shares are intrinsically worth more than ever before; that far from being obsolescent, railways could be given a tremendous impetus by better management, the revision of rates on a better basis than the present one, and by electrification. In the last connection Mr. Farrar considers that it is a "fundamental error" of the grid scheme that the railways were left outside, "whereas they should form the very basis of the country's electrification." He says that "railway electrification would bring down the costs of production for the whole country, and, in conjunction with a new scheme of transport charges, would put us once more in the first place among industrial nations."

Legal.

Edison Storage Battery Co. v. Britannia Batteries, Ltd., and Others.

The proceedings in this action, which have been reported in our last two issues, continued through last week. On March 11th, by Mr. J. F. Monnot, one of the defendants, was cross-examined by Sir Duncan Kerly, K.C. (for the plaintiffs). He said that he had given orders for new notepaper bearing the names of certain directors and omitting all reference to the fact that the new company were sole licensees for Edison. He did not suppose that the correspondence contained any reference to his intention that the old company should not produce and the new company should not sell any batteries but the plaintiffs' batteries until after the agreement had expired. He made all his arrangements verbally, and they had been kept. It was not till after the end of the agreement that the factory at Redditch was proceeded with, and it was not ready until January, 1930. Up to then they carried on with the stock of American batteries which they had, and after that he had a stock of imported ones.

Sir Duncan asked if the new English company was registered to deal only in the goods of the Britannia Batteries, Ltd. Witness replied that it was always understood that he was not to sell English-made goods until after the contract had expired. Counsel suggested that the whole scheme was to enable the Germans to use the name Edison. Mr. Monnot answered that that was not so; it was to enable him to use the name Edison. It was the wish of the Germans that the name of Edison should be retained. They understood that witness would take full responsibility. He was anxious that the British market should have British batteries. The notepaper of Britannia Batteries in 1929 bore the words "Manufacturers of Edison accumulators." It was only used for suppliers. They were buying raw material and wanted the Germans to know what they intended to do. It was not an untrue statement. The notepaper was only in use for a short period.

Witness agreed that the new English company was bound by his contract till it expired. That company was under witness's control, and not controlled by Germans, until witness had completed his agreement. The agreement between the old English company and witness was dated January, 1929. In the autumn of 1928 Mr. Monnot had been approached by the Germans to enable the Germans to manufacture batteries in England after the capital had been reduced. The reduction of capital gave the Germans the controlling interest. The goodwill, &c., of the old company was transferred to him as trustee of the new company. There was no consideration except for services rendered. There were very few shareholders in the old company besides himself; they were offered cash, and many took it. He had carried out his obligation to the American company as long as the agreement lasted.

Sir Duncan pointed out to witness statements in letters from the company to clients, and observed that witness's salesmen did not scruple to make untrue statements to make sales. Replying to further questions, witness said he had applied to the Patent Office for a trade mark for alkaline storage batteries, but when he found that the plaintiff company had made an application to the Patent Office, he withdrew his application.

Sir Duncan asked if a cell was similar in construction in all particulars to plaintiffs' make, except that it contained cadmium, whether witness considered it an Edison cell. Witness replied that it was an "Edison type cell." It would not be fair to describe it as an "Edison cell."

Dealing with the point of passing-off, witness said the advertisements issued offering Edison batteries related to those to be made by the new company at Redditch, and were inserted to draw inquiries.

On March 12th, Mr. Monnot, re-examined by Mr. Simonds, said that after the incorporation of the new company the old company did not sell any batteries except to the new company. With regard to the notepaper, the use of a sheet with the words "sole licensees" was an exceptional case.

Mr. James Jackson, general manager of the Cleaning Department of the City of Birmingham, which employs battery vehicles, said that he looked upon the word "Edison" as a generic term. If he ordered an "Edison" battery to-day he would expect to get one of the Edison type or design.

Mr. T. Stretton, managing director of the Concordia Electric Lamp Co., Ltd., said that he considered an Edison battery or storage battery to mean a battery or type which was originally patented and manufactured by Mr. Edison. Witness was proposing to enter into a business arrangement with the Britannia Co. to manufacture alkaline batteries for him, his chief concern being to get a British battery made at Redditch.

Mr. M. D. Walker, electrical engineer, I. C. I. Metals, Ltd., said that he understood an "Edison battery" to be a nickel-iron alkaline battery, not necessarily a battery manufactured by the Edison Co. of the United States.

Mr. W. E. Lowe, engineer to the Pontypridd U.D.C., said that at first his Council had purchased electrical vehicles from the Edison Accumulators, Ltd. Later he ordered a new battery from Redditch, and went there to see it being made. He had looked forward to this, because he thought it would cheapen the batteries.

Mr. A. J. Marshall, borough engineer of Merthyr Tydvil, Mr. J. W. Scott, managing director of J. W. Scott, Ltd., Southampton, Mr. W. J. Proctor, formerly with Messrs. Rendell, Palmer & Tritton, Mr. G. C. Bond, Maidenhead, and Mr. H. M. Sayers gave similar evidence.

Mr. James Swinburne said that, generally speaking, he understood the expression "Edison battery" to mean batteries invented or introduced by Edison.

Mr. J. O. Bowen, secretary to the Britannia Batteries, Ltd., and Edison Accumulators, Ltd., gave evidence as to the stock list of batteries in December, 1928. The stock was transferred to the new company, and it had some of it in hand still. The value of the stock transferred was £16,929.

Mr. R. L. Kempster, sales manager to Edison Accumulators, Ltd., and the old company, said it was not true that there had been any falling-off of the trade of the company in 1928. Some of the cells purchased from Germany in 1928 were put into stock and disposed of in the ordinary way.

This concluded the defendants' case.

On March 13th, His Lordship asked Mr. Gavin Simonds, K.C., plaintiffs' leading counsel, to go back to the pleadings and particulars to show what the issues were between the plaintiffs and the defendants.

Mr. Simonds said that the writ was issued in July, 1929, and it claimed against the Britannia Batteries, Ltd., the old English company, and Mr. Monnot, damages for breach of contract. Against Britannia Batteries, Ltd., plaintiffs claimed an injunction restraining the defendants, their servants, and agents from selling or offering for sale any storage batteries not of the manufacture of the plaintiffs as "Edison batteries," and from representing that they were the manufacturers of those batteries, and otherwise passing off or attempting to pass off as the plaintiffs' batteries any storage batteries not made by the plaintiffs. The plaintiffs also sought as against Edison Accumulators, Ltd., an injunction restraining them from using the expression "Edison Accumulators" as part of their name or in any manner calculated to lead to the belief that they were the distributors for, or connected with, the plaintiff company.

Counsel considered that the real issue was whether the plaintiffs had a monopoly of the name "Edison." His submission was that as all the parties to the previous agreements, including the plaintiffs, had referred to the cells as "Edison batteries" or "Edison storage batteries," it was not open to the plaintiffs now to say that the terms meant something else.

On March 16th, Mr. Gavin Simonds continued his arguments on behalf of the defendants and on the following day Sir Duncan Kerly summed up the plaintiffs' case.

Judgment was delivered by Mr. Justice Bennett on Wednesday morning, after the case had lasted for 15 days, during which over 6,000 questions were put to witnesses. His Lordship said the question upon which the rights of the parties turned seemed to be a simple one and one on which his Lordship entertained no doubt as to what the answer should be. Mr. Edison's patents gave him a monopoly for their duration to make batteries in accordance with his invention. In 1909 the plaintiffs entered into negotiations with Mr. Monnot with a view to the sale in this country of batteries made by the plaintiffs in accordance with the inventions of Edison. An agreement was afterwards entered into between the plaintiffs and Mr. Monnot. That agreement was superseded by another agreement of August, 1916, between Mr. Edison, Edison Accumulators, Ltd., and Mr. Monnot, dealing with the exclusive selling rights of plaintiffs' batteries. There were other agreements and finally one between the Edison Storage Battery Co. and the defendants, Britannia Batteries, Ltd., the new Edison Accumulators, Ltd., and Mr. Monnot, in March, 1925, dealing with the rights to buy material, &c., to assemble the batteries. That agreement was for five years, with a provision for cancellation. In 1927 Mr. Monnot had said he learned that this contract between Edison Accumulators, Ltd., and himself, and plaintiffs, was not going to be renewed when it came to an end. And therefore he, as he was entitled to do, began to take steps with a view to putting himself and Edison Accumulators, Ltd., into a position to manufacture and sell storage batteries when the contract terminated. With that object in view in May, 1928, he opened negotiations with a German company. Ultimately, an agreement was arrived at, and in 1928 and 1929 was carried through, including changing the name of the old English company and making arrangements for the establishment of a factory at Redditch. All these steps were taken without the knowledge of the plaintiff company and as soon as they learned it they gave notice to terminate the agreement. With regard to the alleged passing-off that depended on the words "Edison storage batteries" or accumulators being distinctive of plaintiffs' goods and denoting goods manufactured by them. The substantial question was whether plaintiffs had made out their case that "Edison storage batteries" or "Edison accumulators" was distinctive of plaintiffs' goods. "Edison" in connection with storage batteries was a manufacturer's mark. Defendants' case was that "Edison battery" was simply a term used descriptively for a battery which embodied in it the invention of Mr. Edison. On the evidence of Mr. Lind and Mr. Monnot that "Edison accumulators" was distinctive of the goods made by the plaintiffs and that the goods Mr. Monnot sold were distinctive goods of the plaintiffs, it seemed to his Lordship that he was bound by that to say that the words were distinctive of storage batteries manufactured by the plaintiff company. The result was that plaintiffs' claim to the injunction to restrain defendants from passing off goods

as and for the goods of the plaintiff, was made out. He came to the conclusion that Mr. Monnot deliberately took a course intending people to believe that batteries which he was selling were made by persons or by companies which were connected with the plaintiffs, when in fact there was no connection between plaintiffs and the proposed manufacturers. He also came to the conclusion that the old English company had committed a breach of the contract and the plaintiffs were entitled to damages, both against the company and Mr. Monnot, with an inquiry as to damages and the costs of the action.

Nuisance Action against Marconi's.

The case of Rose and Others *v.* Marconi's Wireless Telegraph Co., Ltd., came before Lord Justice Romer on March 11th. The action was brought by the plaintiffs as owners and occupiers of houses in Chelmsford for an injunction (and ancillary relief) to restrain the defendants from committing a nuisance by reason of noise and vibration from the working of engines for high-power transmission.

When the case was called on, Mr. Archer, K.C., for the defendants, explained that his clients had to admit a cause of action, but he said that they had lately made alterations in their plant which it was hoped would remove any cause for complaint in the future. The defendants would give an undertaking and would agree to pay the plaintiffs' costs of the action.

The case was settled by consent on the terms suggested, the plaintiffs being given liberty to apply for an inquiry as to damages if it became necessary.

Verdict Reversed.

On March 11th, Lord Darling, sitting in the King's Bench Division, heard legal arguments on the verdict returned for plaintiff for £1,500 in the action brought by Mr. Mark Ward, an engineer, formerly in the employ of the defendants, the Marconi Wireless Telegraph Co., Ltd., for damages for alleged breach of an agreement, against that company. The case was reported in our last issue.

His Lordship held that a further grant was at the discretion of the defendants. They were under no obligation to make a further grant. He entered judgment for the defendants with costs, granting a stay of execution with a view to an appeal.

A Power Company and "Amenities."

In the House of Lords recently, Lords Buckmaster, Dunedin, Warrington, Thankerton, and Russell of Killowen heard an appeal by the Clyde Valley Electrical Power Co. from a decision of the Scottish Court of Session in favour of the trustees of the late Sir Robert Lockhart, of Castlehill. The two parties agreed to terms for the carrying of a power line across parts of the Cambusnethan estate in Scotland. The agreement contained an arbitration clause providing that all disputes or differences which might at any time arise as to the true intent and meaning of the provisions of the agreement should be referred to the decision of a single arbiter to be appointed, failing agreement, by the Sheriff of Lanarkshire, or any of his Substitutes at Glasgow. As a result of the company's operations in erecting poles and wires, the amenity of the estate was destroyed to a material extent, and the trustees made a claim against the company for damages. The company repudiated the claim, and the trustees then requested it to concur with them in the nomination of an arbiter, but the company refused to do so. The trustees then presented a petition asking the Court to nominate an arbiter, but the company opposed the petition on the ground that no question referable for determination to an arbiter had arisen between the parties. The Sheriff-Substitute found in law that on a sound construction of the agreement there was no liability upon the company to compensate the trustees for loss of amenity, also that there was no dispute calling for determination by an arbiter. Upon appeal to the Sheriff, he recalled this decision, and found that a dispute had arisen between the parties which fell within the reference clause of the agreement. He also nominated an arbiter. By a majority the First Division of the Court of Session in Scotland upheld this finding. So the company appealed to the House of Lords on the ground that the averments of the trustees, which related to loss of amenity due to cutting down trees, were irrelevant and insufficient to support the crave of the petition, which related to the loss of amenity due to the erection of poles.

Their Lordships unanimously dismissed the company's appeal.

Power Station Improvement Class.

Some sixty members of the staff of the Chamber Hall power station, Bury, had the opportunity of listening on March 12th to an instructive lecture on "Turbine Operation" by Mr. D. B. Reay, B.Sc., of the Metropolitan-Vickers Electrical Co., Ltd., the chair being taken by Mr. J. G. Potts, engineer and manager. Mr. Reay explained the many factors which go towards running and maintaining a turbine at its highest efficiency, and also various types of feed heating systems, slides and models being shown to explain many points in operation. During the discussion some amusing reminiscences were told of the earlier types of turbines installed at the power station.

Parliamentary Notes.

[By our Special Parliamentary Reporter.]

The Capitalisation of Profits.

On March 9th Mr. Muggeridge asked the Minister of Transport whether he could give the names of electricity distributing companies which had capitalised undistributed profits; the aggregate amount of profits capitalised, and the amount so capitalised during the last two years for which accounts were available; and whether such capitalisation of profits during the period had been accompanied by reductions in charges for electricity.

Mr. Morrison, in a written reply which was circulated to members, gave particulars of 22 companies which had capitalised profits to the extent of £906,599 during 1928 and 1929, making a total so capitalised of £1,101,145 since the inception of the companies. In all but three cases, reductions in charges had been made at the time of the issue of the capitalised profits. The Minister also referred to the capitalisation of the free reserves of the London companies under their special Acts, coupled with the fixing of standard charges. The schedule excluded £600,000 capitalised by Edmundsons' Electricity Corporation, Ltd., since the operations of the company covered other matters than electricity supply.

Electricity Charges in Kent.

On March 9th Mr. Markham asked the Minister of Transport if he was aware that in the neighbouring boroughs of Chatham and Gillingham, both supplied with electricity from the Kent Electric Power Company, two distinct scales of charges were in operation, with the result that residents in Chatham paid considerably more than residents in Gillingham; and would he take steps to equalise the charges to the residents in both districts.

Mr. Morrison said that with regard to the first question he understood that negotiations were at present taking place between the Kent Electric Power Company and the Borough Councils of Chatham and Rochester with regard to the supply of electricity in those boroughs, including an offer by the company to charge the same rates as operated in Gillingham. These negotiations were not yet concluded.

Imperial Telephone Communication.

On March 9th Mr. Attlee, Postmaster-General, informed Mr. Boyce that experiments were being carried out with a view to extending the Anglo-Australian telephone service to New Zealand by means of switching in Australia; and he hoped that it might be possible to open a service between this country and New Zealand in the course of the next few months. As regarded South Africa, the Union authorities concerned had declared themselves in favour of the establishment of a Government-owned wireless station near Johannesburg for the operation of a radio-telephone service with this country, but it was understood that they did not feel able to commit themselves at present to the capital expenditure involved. He understood that the Government of India was in negotiation with the Indian Radio-telegraph Company for the provision of a radio-telephone station for communication with this country, but those negotiations had not yet been completed. Radio-telephonic communication was available between this country and Canada and Australia. The average weekly number of calls was about 17 with Canada and about 27 with Australia. The traffic was rather less than was expected. It had doubtless been affected by the trade depression and should increase when general conditions improved.

Supplies in Cumberland.

On March 11th Mr. Price asked the Minister of Transport whether he was aware that the Parton Parish Council in Cumberland applied two years ago to the Silkstone Company for the supply of electricity to its area; that although the principle was approved, no further action was taken; whether he had been informed as to the cause of the delay; and whether he would take steps in the matter.

Mr. Morrison said that this matter had not been brought to the notice of himself or the Electricity Commissioners, but he had asked them to inquire into the position.

British Steel for the Grid.

On March 11th Mr. Morrison, in reply to Mr. L. Smith, said he was informed that the steel towers and the cables used in connection with the electricity grid scheme were of British manufacture throughout.

Generation of Electricity.

The official returns rendered to the Electricity Commissioners show that 1,006 million kWh was generated by authorised undertakers in Great Britain during the month of February, 1931, as compared with the finally revised figure of 985 million kWh in the corresponding month of 1930, or an increase of 2.1 per cent. During the first two months of 1931 (up to the end of February) the total amount of electricity generated by authorised undertakers was 2,147 million kWh, as compared with the finally revised figure of 2,064 million kWh for the corresponding period of 1930, representing an increase of just over 4 per cent.

Correspondence.

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession.

Earthing.

The question raised by Mr. Chas. W. Wilman in your issue of the 13th inst. really appears to be: "Exactly how applicable are, and what degree of elasticity is allowed by, the Factory and Workshops Acts now in force?" as it is obvious that no supply authority may connect a factory installation that does not comply with the Home Office regulations. I believe the I.E.E. rules, although generally accepted, cannot be enforced in a court of law unless specifically mentioned in the articles of authority for that area of supply.

We may now ask: "Do the Factory and Workshop Acts apply to shop premises?" Exemption No. 7 contained in the Acts rules out domestic workshops, &c., apparently on the ground that the occupier is responsible in law, so that this question may well be asked!

Advice from a legal correspondent may be much appreciated by many engineers who are puzzled how to act when an obstinate consumer refuses to change, for example, a two-pin automatic hair clipper for the standard three-pin earthed type on the ground that the manufacturer has supplied a "full guarantee" (from America!) of the perfect safety (?) of such apparatus.

London, N.12, *March 14th*, 1931. E. W. CARLINE DAY.

British Priority in Metal-clad Switchgear.

Recent reference to American practice in the manufacture of metal-clad switchgear makes it worth while to try to trace the course of development of this product in America. The first step we know of was that in the early part of 1912 we sent several specimen iron-clad (as they were then called) panels to three of the American electricity supply undertakings, one of which was supplied with a single 20,000-volt panel, another with two 12,000-volt separate panels, and the third with three 6,600-volt panels built together to form a switchboard. These were of the horizontal-drawout type, and in general outside appearance were not unlike their lineal descendants of the present day.

We also have it on record that during a visit to our works in the autumn of 1917, Mr. H. M. Hobart was shown some examples of metal-clad switchgear in course of construction; and in an address on "Engineering Progress in Britain," reported in the May, 1918, issue of the A.I.E.E. *Journal*, he made the following statement:—

> "I was much impressed with the rapid progress in employing iron-clad switchgear built together as a complete machine as contrasted with the panel and cell systems used in America. Already three years ago this iron-clad gear was used widely on customers' premises and in sub-stations, but there are beginning to be symptoms of its also competing with the American outfits for high-voltage work in generating stations."

The leaven began to work; the process of permeation followed its logical course of, first, the principle, then the product; and experiments in construction began to be made. For example, when Mr. H. W. Clothier was in the United States in 1925, he saw in one of the large power stations switchgear of the isolated-phase type, as far as building and construction went, but having everything except the bus-bars and the testing terminals designed on metal-clad lines. The chief engineer of the power station said that they had made it as much like Reyrolle's as they could.

This switchgear was of the vertical-drop-down type. Now, consider the course of British practice in this form of switchgear, of which, incidentally, the earliest design in commercial use came from Erskine, Heap & Co. Vertical isolation was proposed by us for the purpose of obtaining oil insulation of isolating contacts in British Patent No. 110,808 (Reyrolle and Co., and Clothier), which was applied for on November 15th, 1916. Vertical isolation was also adopted for large outdoor switchgear equipment, and British Patent No. 238,952 (Reyrolle and Co., Clothier, and Allan), applied for on May 28th, 1924, and accepted on August 28th, 1925, includes in its first claim metal-clad oil-immersed switchgear comprising several oil-containing chambers for various parts of the unit, and "an oil-immersed main switch in a tank beneath the intermediate chambers and removable in a substantially vertical plane." Switchgear in accordance with this patent has been installed for some years out-of-doors at the Valley Road power station of Bradford Corporation, England. The same patent specification foreshadows important modern developments by stating that "the bus-bars may be in oil-filled pipes," and illustrates separate-phase oil-immersed enclosure of switchgear and bus-bars. The development of large outdoor high-voltage metal-clad switchgear on these lines has been more prominent hitherto in American practice than in British practice, which has been influenced by the demand for lower-voltage switchgear more easily accommodated in buildings. The advent of 66,000-volt transmission is making an opening in Great Britain for progress in the use of the high-voltage oil-filled vertical type, of which the Bradford switchgear was the precursor.

All this is not to say, however, that vertical-drop-down switchgear is the type most suitable for every application. In an A.I.E.E. paper on "Metal-Clad Gum-Filled Switchgear," by Mr. L. B. Chubbuck, switching equipment engineer, Canadian Westinghouse Co., which is necessarily an expression of an individual point of view, reference is made to "two large American electrical manufacturing companies" that have standardised vertical switchgear. This does not, however, describe the whole of the American practice. It is doubtless well-known that one of the largest American manufacturers has made considerable quantities of metal-clad switchgear, both of the horizontal and of the vertical types, thus giving users the most efficient service by supplying switchgear appropriate for the conditions of each installation. In this the British practice is followed. We ourselves have found that the most satisfactiry all-round results are obtained by using the horizontal type for indoor equipment with a rated breaking capacity up to 1,000,000 kVA, on account of its accessibility and its ease in operation, inspection, and maintenance, and the vertical type both for larger indoor equipment and for the high-voltage outdoor sub-stations now coming widely into use. There is not much difference between the two types in respect of total cubic space occupied; the horizontal saves in height, and the vertical saves in floor-space. Each has its own particular advantages; to claim universality for either involves neglect of one or another large field of usefulness.

A. REYROLLE & CO., LTD.

Hebburn-on-Tyne, *March 11th*, 1931.

Motor Impregnation.

With reference to Mr. Alfred Harvey's letter under the above heading which appeared in your issue of March 6th, the question of the effectiveness or not of vacuum-pressure impregnation of motors is a subject too lengthy to deal with in a letter, but in my opinion the best method of treating machines exposed to bad conditions as met with in colliery work is as follows. All the wire which is to be employed in the coil winding should be pre-treated in a pigmented enamel by passing the "white" wire from one drum through a bath of the enamel suitably thinned to another drum and then drying. This treated wire should then be used for winding the coils. In the case of field coils a further coat of enamel should be brushed on between each layer and the coil finally baked; in the case of armature coils a similar treatment should be adopted with certain modifications depending on the coil itself, such as shape (strap or wire wound), &c. A final finishing coat of the enamel should be applied to the machine when wound. It will be found that such treatment properly carried out enables electrical apparatus to withstand the most rigid working conditions.

R. T. FLEMING, A.M.I.E.E.

London, W.4, *March 14th*, 1931.

What is a Perfect Tariff?

Mr. A. T. Bullen suggests that the Central Board should charge on a three-part basis. Col. Crompton, in his address at Liverpool University on February 23rd, said he had been informed by officials of the Central Board that the charges will be £500 per annum as a service charge at each point of supply, plus £3 per kW of maximum demand, plus 0.25d. per kWh, with coal at 20s. per ton, the maximum demand being taken during November and December (the demands in other months being disregarded). From this it appears that the Central Board is willing to take the risk of "cold snaps" in January and February.

With regard to a retailing tariff, it is a platitude to say that buying and selling are two different things, but I would point out in this case that the Central Board is not troubled with any psychological problems, whereas the authorised distributor may be well advised to give the psychological aspect careful consideration. I think that Mr. Bullen will agree that the proposal to charge consumers at a high rate just at the time when they require their maximum supply, though perfectly sound from an economic point of view, will be disastrous from the psychological angle.

Bedford, *March 14th*, 1931. J. RUTHERFORD BLAIKIE.

Small A.C. Motor Startors.

In his letter appearing in the ELECTRICAL REVIEW of March 13th, Mr. Goody is kind enough to compliment me on "drawing attention to the diversity of apparatus for the starting of small squirrel-cage motors." Unfortunately I do not deserve this credit. That which in actual fact I had endeavoured to draw attention to was an entirely different point, *viz.*, the diversity of current opinion as to the functions of which such startors should be capable.

If Mr. Goody will kindly re-read my article in the light of the above I think he will appreciate that it is not the absence of startors fulfilling the requisite conditions which is called

into question, but the multiplicity of startors normally offered to intending purchasers which are not designed to protect both operator and machine; these I suggested should be essential, not optional, features and constitute standard practice.

I would suggest that at the present time none of the firms Mr. Goody has in mind includes, for instance, an interlocked isolator and third overload release as standard practice, by which I mean as essentials and not refinements obtainable at an extra price.

London, E.C.4, *March 16th*, 1931. J. P. S. Pillans.

Adjustable Resistance for Radio.

In your issue of March 13th we notice a letter dealing with the use of a valve as an adjustable resistance in a radio circuit. It may perhaps interest your correspondent to know that this arrangement is by no means new, and that it has been used for many years both in conjunction with small types of valves, such as are employed in radio receivers, and also with large transmitting valves as well. In the latter case particularly for experimental purposes, it undoubtedly provides a very useful and convenient adjustment.

In connection with the application particularly to radio receiving devices, we would also draw his attention to British Patent No. 252,554 granted to this company, wherein is described the use of a device of this type by which a similar effect is obtained by the use of two cathodes mounted in a single valve bulb.

Dubilier Condenser Company (1925), Ltd.,
Philip R. Coursey, *Chief Engineer*.

London, W.3, *March 16th*, 1931.

Engineering Degrees.

Referring to the very interesting remarks made in your issue of March 13th by your correspondent "Worried," may I, as a holder of national certificates, say a few words which I trust will be helpful?

I quite agree that the national certificates are not widely known amongst the majority of well-established electrical engineers. However, their lack of knowledge of these qualifications is a pardonable one, as they are only of comparatively recent introduction. The higher national certificate, with an additional qualification of a pass in an English essay examination, exempts one from the Institution of Electrical Engineers examination, formerly known as the Associate Membership examination, and now as the Graduateship examination.

If "Worried" is not already a member, either of the Student or Graduate class, I strongly urge him to enlist, and if he still finds that the "heads" of his firm do not recognise and respect his status, I should be greatly surprised. In almost every instance the holder of a national certificate (the work for which is well up to degree standard) has gained it through the medium of part-time classes, and thus has both theoretical and practical knowledge.

On the other hand, the degree man fresh from college, although probably with a very fertile brain, is comparatively "as green as grass" in the matter of practical experience.

I have found that a man having experience (which is so essential and which also goes to prove that theory and practice do not always go hand in hand) is as a rule always preferred.

It must be a very creditable feat to any man to manage a degree through evening classes alone, and the technical colleges do not usually encourage such an undertaking owing to the vast ground to be covered. I should imagine that "Worried" will find the "dose" a pretty bitter one unless he is of an extremely studious nature, and I should advise him to indulge in some other pastime of a more appetising character.

S. H. Parsonage, Graduate I.E.E.

London, W.4, *March 16th*, 1931.

"Worried's" letter of the 4th inst. raises, I think, a very vexed point, *i.e.*, whether to take one's degree or to concentrate on business. Personally, I am all for the latter, especially if one can study a foreign language. And why should "Worried" wish to add his name to the list of incompetents who already boast a B.Sc.? Personally I think the man who has taken his Grad. I.E.E., especially if he takes it direct, is a far better electrical engineer than any B.Sc. In fact, judging by the type of B.Sc. with which I come into contact, 75 per cent. of them would not pass the Grad. I.E.E. if they sat for it.

Rugby, *March 16th*, 1931. M. W. Hime, Graduate I.E.E.

Cost of Electricity in the Country.

Mr. L. L. Robinson's letters in recent issues are examples of the irrelevances which are always introduced into discussions on contentious subjects, often with the most cynical disregard of the pertinent facts. For instance, what ground for comparison can there be between the case of the old-established undertaking at Hackney, a thickly populated area contiguous to the power station, and that at Burnham-on-Crouch, a rural area about to receive a supply from a source some 40 miles distant?

With regard to Mr. Robinson's own generating costs, these only illustrate the acknowledged fact that it is in general cheaper to do one's own work than to pay somebody else to do it, though it complicates life a good deal and is often a poor job at best; in addition to which the true cost will not be known for some years. In this connection it is noteworthy that some friends of mine living four miles from Hastings have, with several of their neighbours, been glad to scrap their domestic generating sets and avail themselves of the supply recently provided by the Hastings Corporation at rather higher rates than those at issue. Further, I would point out that not even "a fool or a millionaire" can "cook and heat extensively" on a 2-kW Petter and battery.

In conclusion, an inspection of the tariffs in force in many Essex villages not in the County Company's area incline one to the belief that Mr. Robinson is fortunate in being served by an undertaking which is big and stable enough to initiate a supply in Burnham at such comparatively low rates.

Hornchurch, Essex, *March 16th*, 1931. Villager.

Earth Currents.

With reference to the statement of Mr. Stevenson, of Hull, under the heading of "Earth Currents" in your issue of March 13th, perhaps it would interest him to know that some undertakings which are troubled with stray earth currents make a point of connecting an insulated cable to the tram track at different points and running it into a small pillar on the footpath where the track can be permanently earthed by means of a link; this also applies to the lead covering of cables at certain points. Periodical tests are carried out at these points to show the polarity of the tramway rail or lead sheath to earth and this, of course, is an indication of which way the stray currents are flowing. These points can be either opened or earthed at will, dependent on what is happening on the system.

Mr. Stevenson says "In time there would probably have been a breakdown on the lighting cable due to the arcing contact from the earth to the lead sheath." I think it is generally accepted that the breakdown to the cable is due to the current flowing from the cable to the tram rail or water pipe, and is caused by an osmotic flow rather than by arcing. It is therefore better to keep the lead sheath of the cable negative polarity than positive.

March 17th, 1931. C. R. M. Hertford.

"Standard" Cables in the Andes.

It is with particular interest that I notice the illustration in the last issue of the Review of laying "Standard" cables in the Andes, after noticing the same impressive illustrations in an American magazine (*National Geographic Magazine*, December, 1930), which only gives tribute to "North American" engineers and an "American-owned telephone and telegraph company."

It is good at least to know where the cables actually came from.

Walsall, *March 16th*, 1931. J. A. Crabtree.

Electrical Heating in France.

During the course of a series of lectures delivered before the Conservatoire des Arts et Métiers, Paris, Paul Bergeon, Professor of the Institut Electro-technique, Grenoble, says that a fair average winter consumption of electricity for heating apartments and offices in Paris is 20 to 30 kWh per cubic metre. He refers to the estimate of Professor Bone in "Coal and its scientific uses," that in London the losses from harmful gases and sulphuric acid amount to four million pounds per year, and states that Messrs. Kling, Florentin, d'Arsonval, Bordas (Comptes rendus, Académie des Sciences, 1922 and 1926), and Monsieur Labadie (*Illustration*, June 26th, 1926), have shown what a disastrous effect these gases produce in Paris, where every month a minimum of 60 grammes of mineral dust, 15¼ gr. carbon, 15 gr. sulphuric acid, seasoned with a little ammonia and chlorine, pass into the lungs of an adult person. He advocates the use of the thermal storage system which takes advantage of low off-peak rates. It is a system which has already proved itself and has given satisfactory results in numerous installations, such as that of the Compagnie Electrique at St. Etienne, where there are 78 radiators absorbing 337 kW. This installation has worked perfectly since 1926, even during last winter when the temperature fell to −25 deg. C. The schools at Juvisy have 114 thermal storage radiators taking 320 kW, and during 1928-9 when the winter was particularly keen, the total consumption of electricity was 219,570 kWh for 9,000 m² of space heated. In a large house in the Dauphiné district a boiler capable of absorbing 40 kW heats 20 radiators to warm 1,100 m² of space, and has been in work seven years. During that period coal was used only for four days during the coal snap of 1929. The Compagnie du Gaz at Lyons in 1926 installed electric heating in their offices on the accumulator system with two accumulators each of 30 m³ water capacity, this water being heated with current taken off-peak. It has given excellent results for four years. The sanatorium of the Forges de France at St. Hilaire du Touvet was warmed last winter by electricity. In other countries there are several installations of this character in operation, and one of the most interesting is that employed in the offices of the London Underground Railway. (See Electrical Review, September 20th, 1929.)

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1929.

25,180. "Electromagnetic relays." Telefonaktiebolaget L. M. Ericsson. August 24th, 1928. (317,893.)

25,452. "Apparatus for measuring at a distance by means of electric currents." C. A. Hartung. August 21st, 1929. (343,526.)

27,653. "Electric storage batteries." U.S.L. Battery Corporation. September 12th, 1928. (318,928.)

28,202. "Apparatus for passing electric currents through gases, and regulating the same." G. G. A. Brion and A. J. Krutzsch. September 17th, 1928. (319,217.)

28,391. "Electric furnaces." Birmingham Electric Furnaces, Ltd., and A. G. Lobley. September 19th, 1929. (343,529.)

29,727. "Thermo-electric couples." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabricken). October 1st, 1929. (343,452.)

31,404. "Automatic or semi-automatic telephone systems." Standard Telephones and Cables, Ltd. (W. Hatton). October 16th, 1929. (343,503.)

31,699. "Telegraph and telephone systems." W. S. Smith and G. E. Stevenson. October 18th, 1929. (343,535.)

32,244. "Method of, and apparatus for, wireless signalling." J. H. Hammond, Jun. October 23rd, 1929. (343,538.)

34,494. "Means for supplying current to electrically-driven boats for amusement parks and the like." C. W. Thoerig and K. Miessner. September 10th, 1929. (343,541.)

34,649. "Dynamo-electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. November 13th, 1929. (343,505.)

34,707. "Line-protector relays." Siemens & Halske Akt. Ges. November 29th, 1928. (343,507.)

34,843. "Illuminating devices for garages." W. E. Douglas. November 14th, 1929. (343,459.)

34,863. "Circuit arrangements for maintaining constant voltage." L. Korós. November 15th, 1928. (343,511.)

34,936. "Electrically-heated boilers." G. Mascarini. November 16th, 1928. (343,542.)

34,948. "Automatic or semi-automatic telephone exchange systems." Standard Telephones and Cables, Ltd. (W. Hatton and R. Dahl). November 15th, 1929. (343,460.)

34,991. "Loud-speaking telephones." C. Grau. November 15th, 1929. (343,544.)

35,031. "Open-air high-tension switches." Koch & Sterzel Akt. Ges. November 29th, 1928. (343,546.)

35,104. "Influencing the transmission equivalent of discharge tubes, amplifiers, or the like." Siemens & Halske Akt. Ges. November 17th, 1928. (343,486.)

35,215. "Method for connecting current-carrying parts together." Siemens-Planiawerke Akt. Ges. für Kohlefabrikate. October 25th, 1929. (343,468.)

35,216. "Testing apparatus for optical-electrical sound-reproducing devices." Siemens & Halske Akt. Ges. November 19th, 1928. (343,469.)

35,274. "Alternating-current generators." International General Electric Co., Inc. November 16th, 1928. (343,472.)

35,404. "Electric water heaters." G. P. Barker, trading as G. Barker. November 20th, 1929. (343,555.)

35,473. "Apparatus for indicating leakage in pipes, cables, or the like." Standard Telephones and Cables, Ltd., and R. W. Bradley. November 20th, 1929. (343,515.)

35,474. "Carrier-current signalling systems." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). November 20th, 1929. (343,516.)

35,476. "Circuit arrangements for toll telephone systems with repeaters." Standard Telephones and Cables, Ltd. (J. Dorgelo and K. C. Van Rijn). November 20th, 1929. (343,517.)

35,477. "Toll telephone systems." Standard Telephones and Cables, Ltd. (J. P. Verkooy). November 20th, 1929. (343,518.)

35,486. "Alternating-current generators." International General Electric Co., Inc. November 20th, 1928. (343,520.)

35,527. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and R. Taylor. November 20th, 1929. (343,522.)

35,629. "Electric furnaces and electrodes therefor." General Electric Co., Ltd., R. F. Proctor, and H. C. Biggs. November 21st, 1929. (343,563.)

35,665. "Means for generating electric oscillations." B. Williams. November 21st, 1929. (343,566.)

35,799. "Automatic starting of asynchronous dynamo-electric machines." Forges & Ateliers de Constructions Electriques de Jeumont. November 29th, 1928. (343,576.)

35,936. "Rotary switches of the kind used in automatic telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. November 23rd, 1929. (343,584.)

36,209. "Electrical induction furnaces." N. R. Davis and Associated Electrical Industries, Ltd. November 26th, 1929. (343,601.)

36,218. "Telephone systems." Associated Telephone and Telegraph Co. November 26th, 1928. (343,603.)

36,233. "Totalisators and pari-mutuel machines." Clayton Tool Co., Ltd., and E. G. Camp. November 26th, 1929. (343,605.)

36,330. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and C. L. Peters. November 27th, 1929. (343,611.)

36,648. "Circuit controllers for lifting magnets and other inductive devices." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). November 28th, 1929. (343,615.)

36,772. "Magnetic cores for use in loading coils and the like." Automatic Telephone Manufacturing Co., Ltd., and P. N. Rosoby. November 30th, 1929 (343,620.)

36,867. "Electric current transformers." British Thomson-Houston Co., Ltd. December 1st, 1928. (343,623.)

36,887. "Telephone transmission." W. Kaatzer. December 2nd, 1929. (343,625.)

37,490. "Subaqueous signalling apparatus." J. Pintsch Akt. Ges. December 13th, 1928. (343,635.)

38,189. "Electric switches." V. Hope. December 13th, 1929. (343,644.)

38,706. "Electric fires or radiators." H. H. Berry. December 17th, 1929. (343,651.)

39,686. "Control systems for electrical apparatus such as motors." R. W. Mann, F. G. Ferguson, S. Gowan, and Associated Electrical Industries, Ltd. December 28th, 1929. (343,667.)

39,873. "Electric clock with synchronous motor and auxiliary movement." Allgemeine Elektricitäts Ges. August 13th, 1929. (Addition to 343,252.) (343,670.)

1930.

286. "Automatic telephone systems." Siemens Bros. & Co., Ltd., and D. A. Christian. January 3rd, 1930. (343,674.)

605. "Modulating arrangements, suitable for use in wireless and other high-frequency signalling systems." Telefunken Ges. für Drahtlose Telegraphie. January 7th, 1929. (343,678.)

735. "Radio communication systems." Marconi's Wireless Telegraph Co., Ltd. (C. W. Hansell). January 8th, 1930. (343,680.)

866. "Receiving sets." M. V. Timtiman. January 9th, 1930. (343,684.)

977. "Electro depositing on aluminium and aluminium alloys." H. Sutton and H. C. Cocks. January 10th, 1930. (343,685.)

1,553. "Adjustment devices more particularly for use with wireless apparatus." S. W. Naussauer. January 16th, 1930. (343,694.)

2,223. "Electromagnetic relays." Coventry Automatic Telephones, Ltd., and C. C. Puckette. January 22nd, 1930. (343,704.)

3,027. "Lamp for therapeutic purposes." T. Mason and J. I. Jones. January 29th, 1930. (343,707.)

3,195. "Microphones." M. Marinescu. January 30th, 1930. (343,710.)

3,569. "Electric cables." W. Katthage. February 2nd, 1929. (343,716.)

3,897. "Means for making enclosed connections between electrical conductors." W. T. Henley's Telegraph Works Co., Ltd., W. H. Nichols, and E. Moor. February 5th, 1930 (343,719.)

3,950. "Handles for electric switches of the rotary type." C. A. Turner. February 5th, 1930. (343,721.)

4,744. "Electric alternating-current generators." Brush Electrical Engineering Co., Ltd., and C. C. Sutton. February 12th, 1930. (343,733.)

6,712. "Electrical drives for rotary printing machines." Siemens-Schuckertwerke Akt. Ges. March 2nd, 1929. (343,761.)

7,234. "Control systems for electric motors." Associated Electrical Industries, Ltd. March 6th, 1929. (343,766.)

7,339. "Dynamo-electric machines." Associated Electrical Industries, Ltd. March 6th, 1929. (343,767.)

9,049. "Operating means for electric condensers or other instruments." Wilkins & Wright, Ltd., and J. H. Hewitt. March 21st, 1930. (343,784.)

12,066. "Synchronising devices for use in talking film installations." Naamlooze Vennootschap Philips' Gloeilampenfabricken. May 11th, 1929. (343,811.)

12,590. "Speed governors for electric driving motors for gramophones and the like." J. Bethenod. January 20th, 1930. (343,820.)

12,806. "Explosion chambers for oil switches, and the manufacture of the same." British Thomson-Houston Co., Ltd. April 25th, 1929. (343,824.)

13,026. "Electric heaters." British Thomson-Houston Co., Ltd. April 29th, 1929. (343,826.)

13,114. "Chains for electric light." Strepto-Licht Ges. and H. Laur. April 29th, 1930. (343,828.)

13,788. "Systems of electric motor control." British Thomson-Houston Co., Ltd. May 4th, 1929. (343,833.)

16,183. "Electric induction motors." Siemens-Schuckertwerke Akt. Ges. June 28th, 1929. (343,846.)

16,668. "Heavy alternating-current feeders for use in connection with valve transmitters and the like apparatus." Telefunken Ges. für Drahtlose Telegraphie. June 1st, 1929. (343,850.)

17,645. "Electro-optical cells." International General Electric Co., Inc. June 8th, 1929. (343,853.)

19,835. "Electric curling irons." H. Rochat. July 1st, 1929. (343,861.)

22,730. "Valve structures." Associated Electrical Industries, Ltd. July 31st, 1929. (343,866.)

23,021. "Means for the elimination of ripples in cascade-coupled thermionic valves." Telefonaktiebolaget L. M. Ericsson. August 3rd, 1929. (Addition to 309,902.) (343,869.)

35,912. "Electric totalisators." Automatic Telephone Manufacturing Co., Ltd., R. Taylor, L. M. Simpson, F. T. Belas, and J. W. McClew. November 13th, 1929. (Divided application on 342,261.) (343,525.)

1931.

1,854. "Sound records and reproducing systems therefor." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). November 13th, 1929. (Divided application on 34,731/29.) (343,494.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be lodged within one month from March 11th:—

Hamilton Beach. No. 503,554. Class 6. Vacuum cleaning machines.—Hamilton Beach Manufacturing Co., Racine, Wis., U.S.A. (British representatives: Hamilton Beach Sweeper, Ltd., 405, Oxford Street, W.1.)

Everlite (lettering and design). No. 518,461. Class 8. Electric batteries (not for medical purposes).—Everlite, Ltd., Metropole House, Finsbury Square, E.C.2.

Isovox. No. 520,055. Class 8. Instruments and apparatus for radio signalling, sound reproducers and thermionic amplifiers, electric gramophones in combination with radio receiving sets, &c.—J. I. Bernard, "Meadow Croft," Epsom Road, Ashtead, Surrey.

Wethertex. No. 518,620; Wetherlite. No. 518,742; Tropicite. No. 519,624; and Tropalite. No. 519,626. Class 40. Wire, insulated or sheathed with india-rubber and used for electrical purposes.—Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, E.C.4.

Newgands. No. 519,745. Class 50. Electrical insulators made from condensation products of phenol and formaldehyde or from synthetic resins.—New G. & S. Processes Syndicate, Ltd., 33-36, King William Street, E.C.4.

Novite. No. 519,858. Class 50. Synthetic resins and moulding compositions, being condensation products of phenol and formaldehyde.—British Dyestuffs Corporation, Ltd., Hexagon House, Blackley, Manchester.

Chartered Institute of Patent Agents.

The annual dinner of the Chartered Institute of Patent Agents was held on March 12th at the Hotel Victoria, London, W.C. About 180 members and guests were present. After the honouring of the loyal toasts, Mr. Griffith Brewer (president) proposed the toast of "Our Guests," and compared the relations of the patent agent and the inventor with those existing between the musical director and composer. The work of the patent agents was both constructive and destructive; the latter aspect was due to the desirability of preventing unnecessary litigation. The Rt. Hon. L. S. Amery, M.P., responding, said that the patent agent might be regarded as the wet nurse of the invention. Great Britain owed more to inventors than any other country, and the Government had always endeavoured to create the conditions in which the men of genius flourished. Often the inventions had blossomed in foreign lands, but we were beginning to learn better. In visiting the Empire three years ago he had been struck by the enormous difference in conditions since his previous tour, 15 years before, due to the greater use of power. It was no exaggeration to say that the British Empire had been kept together by the submarine telephone cable; television would be an additional help, but nothing would ever take the place of personal contact. Lt.-Col. E. Kitson Clarke, T.D., M.A. (Pres. I.Mech.E.), also responded.

"The Bench and the Bar" was proposed by Mr. F. G. Brettell and responded to by Justice the Hon. Sir Fairfax Luxmoore and Mr. James Mould (in the absence of the Hon. Sir Stafford Cripps, Solicitor-General). These speeches, light in touch, provided very little to record except the obvious mutual respect and regard of the parties that they indicated. "The Chartered Institute of Patent Agents" was proposed by Sir Wm. Jarratt (Comptroller-General of Patents, Designs, and Trade Marks), who pointed to the increased volume of patents taken out in the last few years as evidence of the truth of the proverb that necessity was the mother of invention. Mr. J. E. Lloyd Barnes (past-president) responded. He referred to the high qualifications and ethical standards required of practitioners so that they could be trusted to fulfil a very necessary part of their duty in turning down unsatisfactory applications for patents. The health of the chairman was proposed by Mr. R. W. James.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Angmering-on-Sea (Sussex).—Hotel (£35,000) for W. Hollis; A. Goldsmith, architect, Worthing.

Ashford (Kent).—Houses (56), Hampden, for the U.D.C.; surveyor.

Bacup (Lancs.).—Cinema, Burnley Road; Bacup Land and Building Co.

Basingstoke.—Church, Tadley; H. K. Armitage, architect, 130, Haverstock Hill, Belsize Park, London, N.W.

Bedford.—Reinstatement of Odell Castle for R. C. Alston.

Birmingham.—Elementary school, Severn Street (£34,350), for the E.C.

Blackburn (Lancs.).—Houses, Shadsworth and Langshaw; borough engineer. Cinema theatre (£40,000) for Proprietary Theatres, Ltd., Rochdale.

Bolton.—School, managers of St. Peter and St. Paul Church, Pilkington Street; H. Greenhalgh, 15, Mawdesley Street.

Bradford.—Extensions, St. Luke's Hospital (£10,720); city architect.

Bristol.—Houses (86), Hillside estate (£31,295); Simms, Sons & Cooke, Ltd.

Bury (Lancs.).—Flats (200), Woodhill Road, Knight Street and Cameron Street; borough engineer.

Canterbury.—Senior school (£20,000) for the city E.C.; director of education.

Castleford.—Houses (300), Lumley Hill, Whitwood, &c. Extensions, Maternity Home, for the U.D.C.; L. Birch, surveyor to the U.D.C., Town Hall.

Cheadle (Staffs.).—Houses (140) for the R.D.C.; surveyor.

Cheshire.—Grange school, Runcorn (£40,000); county architect, Chester.

Chorley (Lancs.).—Hospital, Brookwood site (£40,000); secretary to Chorley Hospital.

Derby.—Cinema, London Road; Cosmo Cinema Co. Municipal offices, police court, public market, &c. (£300,000); borough surveyor.

Dewsbury.—Extensions, Stanley Press, Ltd.; Firth, Son and Blackburn, architects, 22, Wellington Road.

Doncaster.—Omnibus garage, Intake (£30,000); transport manager. Extensions, Technical College (£41,550); borough engineer, Guildhall.

Durham.—School, Bolden; F. Willey, architect, 34, Old Elvet. Extensions to science dept. of the University (£18,000); W. T. Jones, architect, North Bailey.

East Riding.—Extensions, Bridlington High School for Girls, for the county E.C.; B. B. Stamford, county architect, Beverley.

Eccles.—Cinema, Market Place, for P. Ashcroft, Pendleton; Drury & Gomerall, architects, Imperial Buildings, Oxford Road, Manchester.

Edinburgh.—Extensions, George Herot's School (£48,000); G. Reid, architect. Washhouse, Dalry (£14,000); city architect.

Epsom (Surrey).—Extensions, head post office, for H.M. Office of Works, King Charles Street, London, S.W.

Eston (North Riding).—Cinema; S. H. Lawson, Emerson Chambers, Newcastle-on-Tyne.

Evesham.—Houses (58) for the T.C.; borough surveyor. Cinema for Super Cinema & Theatre (Evesham), Ltd.; Satchwell & Roberts, architects, Birmingham.

Falkland (Stirlingshire).—Linoleum factory (£120,000) for the Scottish Co-operative Wholesale Society, Morrison Street, Glasgow.

Featherstone (Yorks.).—Library; surveyor to U.D.C.

Gateshead (Durham).—Fire station, police court, &c. (£125,000); F. H. Patterson, engineer, Swinburne Street. Conversion of works into warehouse and stores for H. Binns, Son & Co., Ltd., Newcastle-on-Tyne; Cakett & Burns, Dick, architects.

Haslingden (Lancs.).—Houses (100) for the T.C.; borough surveyor. Extension, Municipal Offices (£69,000); borough engineer.

Hastings.—Cinema and variety theatre, near Warrior Square Station; J. B. Mendham, architect for H. J. Harvey. Alterations, Baptist Church, Wellington Square; alterations, Adelphi Hotel, Warrior Square; Ward, Son & Wray, architects. Additions, Sussex Hotel, Marina; P. H. Oxley, architect. Cinema; H. J. Harvey, builder, King's Road.

Haydock (Lancs.).—Houses (62) for the U.D.C.; surveyor.

Hetton-le-Hole (Durham).—Houses (50) for the U.D.C.; G. W. Sparrow and F. W. Goodyear, builders.

Hitchin.—Houses (154), Walsworth site, for the U.D.C.; surveyor.

Hull.—Hotel, Beverley Road, for the Corporation; city architect. Rebuilding printing works, electrically equipped, for R. Johnson & Sons, Lowgate.

Irish Free State (Cortubber, Co. Monaghan).—Improvements to the National school; Rev. J. O. Reilly Boyle, Croghan. (Rathnew, Co. Wicklow).—National school; Very Rev. Canon Hoey, The Abbey, Wicklow.

Kingussie (Inverness-shire).—Reconstruction, Victoria Hall, with electrical work; J. G. Chisholm, architect, 15, Union Street, Inverness.

Lancashire.—Schools, Farington and Ormskirk, for the county E.C.; also senior school, Bromley Cross, Turton; county architect, 16, Ribblesdale Place, Preston.

Leeds.—Hotel, City Square; L.M. & S. Railway Co.

Liverpool.—St. Paul's Church, Formosa Drive; J. Henshaw and Sons, builders, Chatham Street. Cinema, at the Stadium, Pudsey Street; manager. Synagogue, Laurel Road, for the Building Committee of Fairfield Hebrew Congregation; Houghton & Sons, builders, 292, Kensington.

London (East Ham, E.).—Baths extensions (£18,000); borough engineer. (St. Marylebone, N.W.).—Tenements, Carlisle Street area (£25,257); W. H. Gaze & Sons, Ltd., Kingston. (Brockley, S.E.).—Bakery for Woolwich Arsenal Co-operative Society; secretary. (Hammersmith, W.).—Building, Galena Road; S. E. Richardson. Buildings, Paddenswick Road, Lewis Solomon & Son. (St. George-in-the-East, E.).—Wesleyan chapel (£12,000); secretary, East London Wesleyan Mission.

Macclesfield.—Town Hall for the Corporation; H. Q. Farmer, architect, 102, Brock Street, Cumberland Street.

Manchester.—Factory, Waterloo Road, for H. Marks, Langston Street, Cheetham; Normanton's, Ltd., builders, 167, Plymouth Grove. Enlargement, New Moston School (£18,000); city architect. Houses (1,000), Wythershawe; director of housing, Town Hall.

Midhurst (Sussex).—Cottage hospital (£12,000); Mrs. Harding-Newman, hon. secretary.

Morpeth (Northumberland).—Institution for mental defectives (£180,000), for the C.C.

Newcastle-on-Tyne.—Extensions to premises, Clayton Street ;W. Hall, Ltd., builders, Derwentwater Road, Gateshead. Extensions to factory, Watson's Toffee Works, Ltd., Byker, Newcastle; R. Burke, architect, 12, Grey Street, Newcastle.

Newport (Mon.).—Reservoir, Talybont (£410,000); borough engineer.

Northumberland.—Extensions, Moot Hall, Newcastle, for C.C. (£96,000); H. Kelly, Ltd., contractors, St. Mary's Place, Newcastle.

Orrell (Lancs.).—Police station; Lancashire Standing Joint Committee.

Oxford.—Houses (160), Cutteslowe; city surveyor. Bank, St Aldate's Street; Barclays Bank, Ltd. Extensions, Manor House, for Balliol College; Kennedy & Nightingale.

Plymouth.—Erection of ward blocks, &c., and extensions to nurses' home, Mount Gold Hospital; J. Wibberley, city engineer, Sun Buildings.

Pontefract.—Houses (100) for the T.C.; borough surveyor.

Portsmouth.—Works, Paulsgrove; Sealand Petroleum Co., Ltd.

Radcliffe-on-Trent (Notts.).—Extensions, mental hospital, for the C.C.

Ripon.—Alterations to the Palladium Kinema, Kirkgate; Hustler & Taylor, architects, Pontefract.

Rotherham.—Stores, Bardley Moor Lane; Rotherham Co-operative Society, Ltd.

Royston (Yorks.).—Methodist church and school; W. Morris, West Avenue.

Sheffield.—Extensions, Queen's Road depôt; city engineer.

Shrewsbury.—Waterworks (£115,000); borough engineer.

Smethwick.—Offices, Bridge Street; J. A. Phillips & Co., Ltd.

Southampton.—Rebuilding of premises for the British Colonial Furnishing Co.; Udalls & Co., Ltd., contractors.

Southport.—Floral hall, with electrical work (£13,972), for the T.C.; Duxfield Bros. (Southport), Ltd., builders. Opera House, Lord Street; borough engineer.

South Shields.—Alterations, King Street; Marks & Spencer, Ltd.

Surrey.—Girls' secondary school, Kingston; county architect, Kingston.

Sutton (Surrey).—Extensions and nurses' home, Downs Hospital (£54,295); L.C.C. architect.

Truro (Cornwall).—Sewage disposal works (£27,949); Carkeek & Son, Redruth.

Wakefield.—Houses (92), New Street area; Municipal offices, Lawefield Lane; and extensions, Technical College; city architect.

Warrington.—Church, Henshall Avenue; Rev. J. L. Cullen. Extensions, Winmarleigh Road; Y.M.C.A.

Watford.—Bank and shops (Chalk Hill); J. Rodwell.

West Riding.—Schools, Harewood Lane, North Elmsall, and Wath, for the county E.C.

Whitley Bay (Northumberland).—Houses (360); Haye and Gray, architects, Church Street, West Hartlepool.

York.—Aeroplane factory for a syndicate; N. S. Norway and A. H. Tiltman, joint managing directors.

The
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Combustion Control

BOILER-firing control has received too little consideration by supply engineers, notwithstanding the fact that it is common to the much talked of questions of pulverised-fuel *versus* stoker firing, high- or low-pressure and temperature steaming, and good- or poor-quality coal. The subject has been brought to the fore by the latest development in this country, the adoption of automatic control at the new Kirkstall power station of the Leeds Corporation electricity undertaking, a description of which we publish in following pages of this issue.

The boiler house plays by far the most important part in the fight for the two outstanding requirements of electricity generation efficiency and flexibility of operation. There are two definite and opposing trends with regard to plant layout to secure high efficiency; that leaning towards the simple boiler-engine-condenser scheme, and that favouring all manner of auxiliaries, the object of some of which appears to be to beat the Carnot cycle by extending the use of the latent heat of the steam.

Uniformity of control is the keynote of success with regard to boiler management, and the question arises: which will afford the greater degree of uniformity, simplification or complication? Certainly with hand control the simpler the plant the better for actual operation, while complication may be the justification of the automatic method. Deduction brings us to the simple issue—to what extent can the complexity of the apparatus be increased and very wide load fluctuations be met before the human element loses the grip.

Without entering into the *pros* and *cons* of simplification *versus* complication, we feel that automatic control is not justifiable under present load conditions; but possible load fluctuations of the order of 100,000 kW under the grid operation are being talked of. Are we to expect breakdowns daily, or do the exponents visualise a dominating traction load? Undoubtedly power-station loading conditions are to be changed, and probably before many years our ideas of base and peak loads will have to be remodelled.

Advocates of automatic combustion control have emphasised the claims for advantages in connection with pulverised-fuel firing in meeting exigencies pertaining to the use of low-grade fuel, indeed we believe that the method was first established for working with p.f. firing; at the new Leeds station, however, coal of high calorific value is used, and the care taken in the laboratory must result in the risk of non-uniform fuel conditions being far less than that in most stations in this country.

Automatic control has a bearing also on the question of supply continuity. As with everything else, electricity supply can be safeguarded absolutely (within the sphere of human control in its broadest sense)—at a cost. To what extent is playing for safety justified?

Another aspect of the subject is the cost of labour. Large modern boiler houses with hand control are nowadays managed by one man; can the labour requirements

of the " automatic " plant be reduced lower than this? We think not. Further, would a specially skilled class of labour be required for control equipment adjustment?

There is one particularly favourable point about automatic boiler control, at any rate the system employed at Kirkstall, the control equipment proper is simple and thus has a high reliability factor.

Whether or not automatic governing proves to be the right method for future conditions, one fact must not be overlooked—the courageous move at Leeds and other places has immense research value to the supply industry as a whole.

Fifty Years!

ARE we as ready to do honour to the architects and builders of big electrical industries as we are to acknowledge the great debt that we owe to our eminent scientists and inventors? Science is no longer the Cinderella—she is wedded to Prince Industry! Nowadays everybody recognises that the two must go hand in hand. There was a time when the financial reward of the inventor was poor, and, discovering the error, we placed him upon a pinnacle of fame for admiration by posterity. In meting out our rewards, however, are we doing full justice to the founders and controllers of our great industries? How many of our readers can name off-hand a dozen of the outstanding men who, say, fifty years ago were laying the foundations of great businesses which, dovetailing together, now form a large part of that magnificent whole which we term the electrical industry? Millions of money yielding profitable returns to shareholders have been invested; hundreds of thousands of men have found electrical employment; a great trade is being done; and British reputation for our products stands high. Some pioneers have made fortunes—others have lost them. They need no monuments of stone—these men—the great electrical factories stand out boldly. Some of the men of electrical industrial fame are with us still and we do well to salute them. To one of them, this twenty-seventh day of March, 1931, brings both wistful retrospection and much gratification for, as we state in our " Personal " page, exactly fifty years have passed since George Sutton began his ever-progressive connection with Henley's—the business set afoot by William Thomas Henley—of which he is now the honoured chairman. To you, Sir George Sutton, Bart., we tender our own and the industry's heartiest congratulations!

The Whirligig of Time

SIR WILLIAM BRAGG told us at the E.D.A. luncheon last Friday that the Royal Institution was once a publicity organisation. Next autumn it will revert for the nonce to its original character by taking the lead, supported by the Institution of Electrical Engineers and other scientific bodies, in demonstrating the unique historical significance of the discoveries of Michael Faraday. The invitation to students to act as public guides at the Albert Hall Exhibition will be a privilege indeed to the youth of this generation and the work of fitting themselves for the task will be for them a liberal education. They will do well to take as their guiding idea that Faraday was a great exponent of simplicity in explanation as well as in experiment. The Faraday celebrations should go far to remove what Sir William referred to as our " inferiority complex " —probably in its varying manifestations the most inhibiting influence in the world.

Money Must be Found

THE annual report of the E.D.A. Council, which is reviewed in this issue, shows that the Association's revenue rose last year by about 19 per cent. This was due not only to the enrolment of new members, among which we are glad to see the Glasgow Corporation, but also to the decision of several other undertakings, already members, to subscribe the full amount on the recognised scale. The Association's thanks are also due to the E.C.A. for a special contribution of £1,025 to the funds. But who can feel satisfied with a total of £37,000, which seems a pitifully small amount for the powerful group of electrical industries to pay for the invaluable services which E.D.A. provides? The report shows how wide and varied the Association's activities are. Unless these activities are supported and strengthened in every direction they must represent a mere dissipation of energy. By means of the area sub-committee and circle system, E.D.A. has gathered together and organised a great body of enthusiastic workers in the cause of development. These men and women devote considerable time to this work, but their efforts could be made far more effective if more adequate funds enabled the Association to back them up by arranging attractive demonstrations on a suitable scale, by more insistent advertising, and by the many other means which money would render possible. Sympathy and approval are not enough; hard cash is called for if E.D.A. is to be a power in the land.

The Norwich Scheme

IN the description of the Norwich rural electrification scheme issued by the Electricity Commissioners at the end of last week, we notice that, while substantial allowances have been made for canvassing and advertising in the first five years, no such provision is included in the estimates of subsequent years. We gather that the expenses of management are then considered to cover development work, but we are not told whether such expenses will be correspondingly increased. There should be no difficulty in selling electricity for lighting, while as a result of energetic propaganda a cooking load and a certain amount of water heating and intermittent heating will follow, especially as there is no gas available. The 500 kWh per consumer expected in the sixth year is not sufficiently in advance of the 432 kWh now obtained from the average rural *domestic* consumer to warrant reducing development expenditure. To secure the residual load, after the satisfaction of the more obvious demands, will require skill of a high and specialised character. Not less but more money should then be allocated to development work, even if it necessitates the postponement of the time when profits can be earned.

Modern Lighting

SEVERAL recent lectures and papers on the trends of modern practice in artificial illumination have contained much solid food for thought that should repay careful assimilation. The popular idea that modern lamps are highly efficient light-producing devices is unfortunately quite erroneous; notwithstanding wonderful development, they are, at best, capable of but a fraction of the theoretically possible; and the jubilee of the incandescent filament lamp has heralded the advent of a serious rival in the form of the luminous gas-discharge tube. Apart from efficiency, the latter is undoubtedly destined to play a very important part, perhaps sooner than is generally realised, even in the domestic sphere, and the consequent removal of the source-shape restriction will materially influence the design of fittings; indeed, such a tendency has already become evident. Illumination rightfully claims its place among the useful arts and the designer of lighting systems must be as much an artist as an engineer, aiming to achieve his utilitarian purpose in a pleasing way, and, as Dr. J. W. T. Walsh remarked in a lecture which is briefly reported elsewhere in this issue, the above-mentioned tendency should aid him to do so. It is sometimes argued that the pendulum of fashion has swung so far from the hitherto guiding principal of functionalism as seriously to limit utility in the effort to produce artistic effects, but it must be remembered that the design of fittings has been given an entirely new orientation, and so it is not surprising that the bewilderingly wide range at present available has led to mistakes at times and unexpectedly disappointing results. Meanwhile, until the art has established itself, all that can be done is the promotion of the study of some of the examples which are generally acknowledged to be successful in an endeavour to deduce from them some guiding principles. That seems to be the most urgent duty of the lighting engineer of to-day.

Pulverised-fuel firing, long-distance conveyance of powdered coal, and automatic boiler control render the new power station of the Leeds Corporation of outstanding interest.

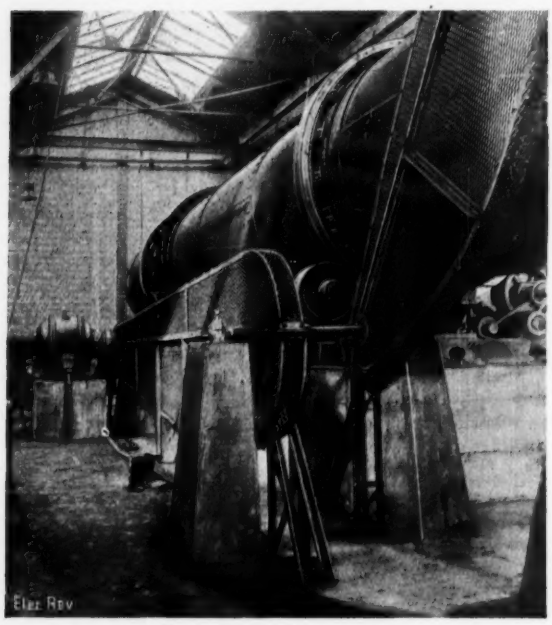
THE new Kirkstall power station of the Leeds Corporation electricity undertaking has now been running under light-load conditions for about four months, and the results so far, although they are not representative of the normal station working, suggest that the confidence of the general manager and city electrical engineer, Mr. C. Nelson Hefford, M.Sc., M.I.E.E., who made somewhat drastic departures from usual practice when designing the station, will be fully rewarded. The station has been laid out for an ultimate plant capacity of 150,000 kW, the limit for the initial section being 50,000 kW. It is to be a base-load station working in conjunction with the grid, so that it is not likely to be fully developed until the grid is in operation. A sub-station of the Central Electricity Board is being built adjacent to the works site, and it appears to be near completion. The average weekly coal consumption up to the present has been 1.55 lb. per kWh, using coal of about 12,150 B.th.u. per lb. calorific value, resulting in a thermal efficiency of about 20 per cent., with a very poor load factor. During February the maximum load on the station was 16,000 kW, and the kWh generated totalled 3,498,700. There is at present a load couple of something like 10,000 kW between the two Leeds stations at Kirkstall and Whitehall Road.

The site covers some 104 acres, and is situated between the Leeds and Liverpool Canal and the River Aire, roughly on a line from Armley to Kirkstall, and adjacent to the L.M. & S. Railway, sidings from which are taken to the boiler house and the turbine room. It will be seen from the lay-out plan that the railway prevents the main building being close to the canal or coal-receiving point, with the result that the coal, after milling and drying, is conveyed some 1,000 ft.; this is believed to be the longest transportation of dry pulverised fuel in this country. The main building has a pleasing appearance, being of red brick ornamented with terra cotta facings and copings. It embraces the boiler and turbine houses, control and switch rooms, and also a block of administration offices, stores, laboratory, &c. Adequate natural lighting is provided at every part.

The canal serves as the transit medium for the coal, a special branch providing the necessary berthing and unloading facilities, and the condenser water is taken from the river. Two telphers and tracks, each of 40 tons per hour capacity, receive the coal from 60-ton barges and discharge it through an automatic weighing machine into a 300-ton storage bunker, the weigher and bunker being incorporated in the telpher-plant structure at the end of the tracks. Two separate belt-conveyor systems carry the coal either to bunkers at the top of the coal-preparation house or to the storage ground. A 10-h.p. dust- and weather-tight motor installed in the open drives the storage-ground conveyor. The other conveyor is served by a 5-h.p. motor at the elevated end. The telpher plant was installed by Isles, Ltd., the conveyors by the Underfeed Stoker Co., Ltd., and the weigher by Richard Simon and Sons, Ltd. There are three inclined rotary dryers, each served by a 70-ton bunker overhead and driven by a 70-h.p. motor. The flue gases from a small hand-fired furnace, one for each dryer, are carried through the inner cylinder of the dryer and back through the annular space between the cylinders, containing the moving fuel, and exhausted under the influence of an induced-draught fan. The coal from the dryers is passed into screw conveyors, picked up by two bucket elevators and delivered into dry raw-coal mill bunkers, one over each of three mills. A 10-h.p. motor serves the screw conveyor, and a 7.5-h.p. motor drives each bucket conveyor. The conveyor and elevators were supplied through International Combustion Co., Ltd. From each dry raw-coal bunker the coal falls by gravity on to an automatic rotary feeder and into a 15-ton Raymond mill. Each mill is driven by a 200-h.p. motor, the mill-spider speed being from 98 to 100 r.p.m. and the roller speed 300 r.p.m. A 100-h.p. exhauster fan sends the powdered fuel from the mill to the cyclone, in which the coal not of requisite fineness is by-passed back to the mill, and a screw conveyor carries it, *via* a weir, to the p.f. bunker. Each mill is equipped with two rotary feeders of the fluted-spindle type, working through a ratchet arrangement and driven by a 1-h.p. motor, each feeder being capable of doing the whole of the work. The pulverised coal falls under gravity from the p.f. bunker into two fuel transporters which convey the fuel by screw transmission to the pump head at the end of the p.f. line. Each transporter is driven by a 75-h.p. motor, 720 r.p.m., and is capable of delivering 40 tons of fuel per hour. In conjunction with each transporter works an Alley & Maclellan compressor, 100 h.p., which delivers at 75 lb. per sq. in. to the pump head, thus blowing the powdered fuel through the pipe lines to the steam-generator bunkers. The pipe line is carried on a five-span steel bridge over the railway. For the supply to the pulverising machinery and coal-handling drives there is a brick-built sub-station at hand equipped with three 750-kW, three-phase, Hackbridge transformers and G.E.C. cellular switchgear, 6,600/346 V.

The boiler house is 95 ft. high, 76 ft. wide, and 142 ft. long. In each p.f. pipe line at the entrance to the bunkers is an electrically-operated valve controlled from the firing floor. The bottom of each bunker finishes in three suitable hoppers in the boiler-house basement, and the fuel from each falls into a fuel feeder driven by a small six-speed motor, and is driven along a short pipe-line to a junction with a similar line connected with a primary-air fan driven by a 57-h.p. motor. From the junction single pipes are arranged across the basement and vertically up the fronts of the boilers to the "Lopulco" turbulent burners, conveying the mixture of fuel and primary

air. There are three 175,000-lb. Stirling tri-drum boilers, each complete with a Foster economiser and a superheater by the Superheater Co., Ltd. The boiler steam conditions are 490 lb. per sq. in. and 750 deg. F. Excluding the basement, there are four galleries or floors arranged round the boiler walls, from the firing floor at the bottom to the drum level at the top. The induced- and forced-draught fans are arranged on the floor next to the top. The flue gases from each economiser pass through an air pre-heater to the i.d. fan and into the stack *via* a Davidson cyclone, and the f.d. fan delivers air through the air heater, working on the regenerative principle, to the primary-air fan. The economisers, boilers, and air pre-heaters are cleaned by Parry soot blowers. Other features of the boilers are automatic Hopkinson regulators and



One of the Rotary Coal Dryers

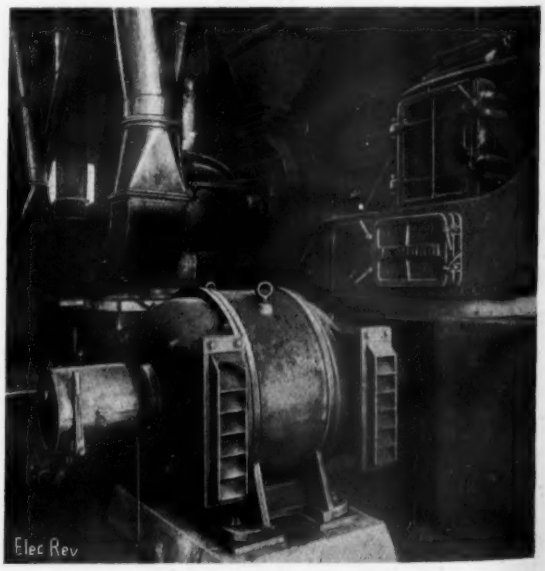
electrically-operated stop valves controlled from the firing floor.

The boilers are equipped for full- or semi-automatic, or hand operation on the Bailey system, and the required method of operation is brought about by an indicator switch on the chart panel flanking the front of each boiler. A second facing panel serves for the control of the fuel-feeder motors, and is equipped with "start" and "stop" push buttons, &c., and a resistance regulator. The "nerve centre" of the control system is at the back of a small panel facing the boiler. A small copper-tube spiral, similar to a pressure-gauge spiral, is directly connected to the steam range. As the spiral expands and contracts with the steam-pressure variations, a horizontal arm, corresponding to the instrument pointer, is moved up and down and completes the circuit between one of two pairs of contacts, according to the direction of movement. A very small motor continually moves the contacts to and fro, thus making and breaking the circuits, so that with each "make" an operation is performed, advancing or retarding one step on the motor rheostat. This apparatus can be made to operate through the necessary relays any or all of the apparatus governing the boiler working: draught fans, damper, fuel feeders, and so on. There are two i.d. fans, and as soon as full load on one motor is reached the second fan is put into operation by a connection on No. 1 rheostat. The flue damper working in conjunction with No. 1 i.d. fan is operated by hand, and that for No. 2 i.d. fan is electrically operated. There are three Bailey charts on each panel. One records steam pressure, air flow and evaporation, "synchronism" indicating 15 per cent. CO_2; water inlet and outlet and steam temperatures on the second; and the air-heater, economiser and boiler outlet gas temperatures and air-heater outlet air temperature on the third instrument.

The flue gases from each boiler unit pass through two cyclones, and the grit and dust deposits are collected in dust boxes beneath, fed in each case through a valve which operates under the weight of the deposit, so that cold air cannot get back into the cyclones.

The ash and dust removal is carried out by a "Hydrojet" installation by the Ash Co., Ltd., in connection with which a vacuum exhauster driven by a 20-h.p. motor and supplied by the British Vacuum Cleaner Co., Ltd., is installed. The vacuum plant removes the dust from the boxes to a receiver outside, and when the latter is filled, water pumps are put into operation and project a stream of water through a tee connection at the back of the base of the receiver in such a manner that the dust is carried by suction with the water into a tank below. Finally, a slurry pump transports the mixture to a settling pond on the site. There are two vertical water pumps, each driven by a 75-h.p. motor. The "Hydrojet" plant also serves for the ash removal and also to clear the dust from the economisers and air preheaters. From the combustion chambers the ash falls into a chamber in which it is sprayed with water jets, and the mixture falls into a trough in which it is carried at a high velocity direct to the tank outside under the influence of duplicate 100-h.p. ash-sluice pumps installed in the condenser basement and drawing water from the main condenser discharge duct. The dust from each economiser and air preheater falls into an inclined pipe line, at the head of which is projected water in similar fashion to that for the dust receivers. The valve controls for the dust- and ash-removal installation are all conveniently located. There are two vertical steam receivers connected in the main range between the steam and electricity generating sets.

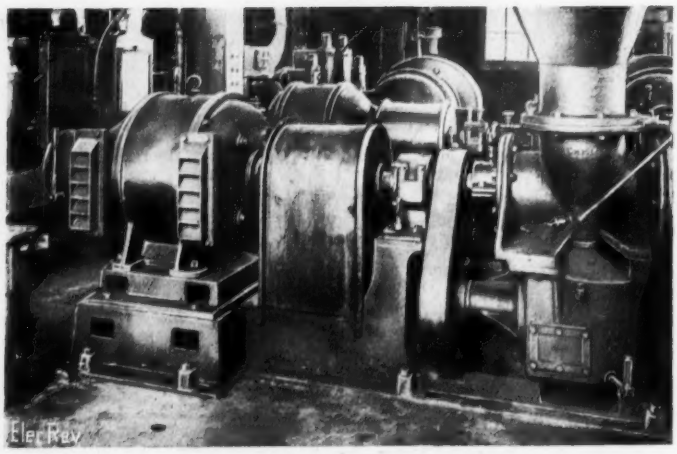
The turbine-room main plant consists of two B.T.-H. 25,000-kW turbo-alternators, 3,000 r.p.m., 50 cycles,



Some of the Coal Milling Gear

11,000 V. The turbines are two-cylinder machines, the h.p. cylinder being of the pure impulse type with 16 stages, and the l.p. section of the double-flow type with reaction blading. The turbine stop-valve steam conditions are 460 lb. per sq. in. and 720 deg. F. Each turbine is equipped with instruments for measuring the steam flows to the turbine, pumps and ejector, separately, "Electroflo" efficiency meter, "Dionic" water-purity meter, &c. Owing to the particularly dirty state of the River Aire, large vertical Allen surface condensers fitted with 1-in. diameter cooling tubes are employed to receive the turbine exhausts, a condenser being positioned beside each turbine. The normal working for the condenser circulating system is two-flow, but by means of electrically-operated valves

Representative views of Kirkstall Power Station. (1) Boiler front; note open burner doors and control board on right. (2) View in switch house; higher capacity equipment on lower level. (3) Control room by night. (4) Turbine room; vertical condenser on left showing electrically operated valve. (5) Coal-handling plant. (6) Exterior of main building floodlighted.

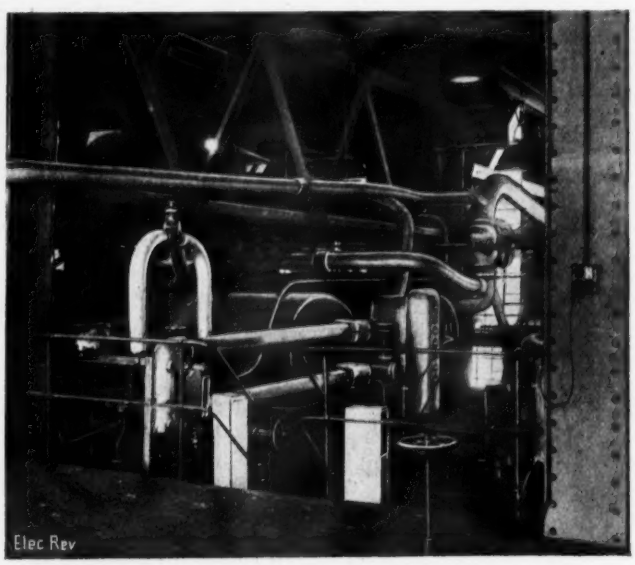


Coal Transporters: Fans at Rear

under push-button control, the system can very easily be converted to single- or reverse-flow, the latter being employed for removing the deposits at the bottom when necessary. An "Allen" air ejector and two Allen extractors, one electric and one steam, are employed for each condenser. The steam and water system is arranged on the closed-circuit principle, an Allen evaporator being arranged in the circuit and the balance adjusted by a surge tank. The make-up water is obtained from a well on the site, and the pumping is electrically operated. In the circuit are also arranged Allen heaters fed with steam "bled" from the turbines. There are three extraction points on each turbine, two only of which are at present used. Three Weir steam feed pumps operate in conjunction with each set, 5,000 r.p.m., 200,000 lb. per hour. The circulating-pump driving arrangements are somewhat unusual. A lift of about 30 ft. to the top of the condenser requires some 700 h.p. at the start, but when normal working establishes a siphonic action the power required is reduced to about half. To meet these conditions a motor of 700 h.p. at a two-hour rating and of 350 h.p. continuous rating is directly connected to the turbine pumps. On the same shaft is arranged a smaller machine which, when siphonic action has been established, is cascade connected with the larger motor, reducing the speed from 367 to 289 r.p.m., and the output capacity to 350 h.p. The motors are supplied direct at 6,600 V. At the river inlet are four "Brackett" water screens driven through two-speed gearing. In the condenser basement is a little electrically-driven exhauster pump by means of which any pump in the building can be primed.

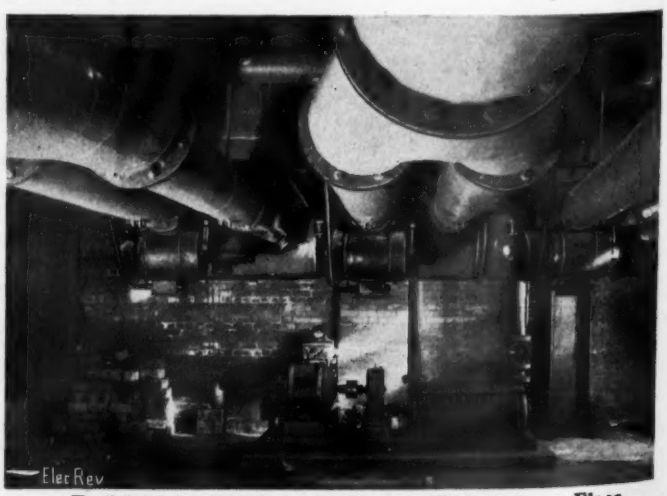
Each alternator is directly coupled to the turbine shaft and is ventilated on the closed-feed system by air passed through water-treated air coolers, the water for this purpose being pumped from the well. The alternator fan is carried on the main shaft. The excitation of the alternator is stabilised by means of main and auxiliary exciters on the same shaft, the auxiliary machine exciting the main one at constant voltage by virtue of its saturated magnetic circuit.

The main switchgear is all of the vertical-isolation type of Ferguson Pailin, Ltd., and is located in a special house adjacent to the turbine room and served by a crane and a railway siding. There are two galleries at different levels containing the two sizes of switchgear: 1.5 million kVA rupturing and 2,000 A carrying capacity on the lower level, and 0.5 million kVA (400 A) on the higher gallery. The higher-capacity equipment is all for 11,000-V working and serves for the generator controls and some of the larger outgoing circuits. Some of the lower-capacity switchgear operates on the 6,600-V coupling feeders between the undertaking's two generating stations; the other provides for 11,000-V outgoing feeders. The bus-bars are duplicated, and two breakers are incorporated in each circuit. Under the upper gallery are located Hackbridge 10,500-kVA transformers for the station interconnectors, 11,000/6,600 V. The whole of the main switchgear is, of course, electrically operated from the control room. There is little that is unusual in this section, and the equipment is of the standard "open-panel" type supplied by Messrs. Ferguson Pailin, Ltd. The control boards are arranged in three main sections, two for the 11,000-V equipment and one for the 6,600-V gear. Over the boards are mounted the usual connection diagrams. Voltage regulation on the station couplers by "on load" tap changing on the transformers is effected by push buttons. The equipment in this room also includes temperature recorders for all the transformers, and also Hopkinson telegraph signalling equipment to the turbine room, &c.



Top of Boiler: Periscopes for Water Gauges

Practically all the works auxiliaries are supplied at 346 V, 3-phase, and the supply, except for the coal-treatment section, is obtained from a works sub-station arranged on a gallery on one side of the turbine room. A notable feature of the station is its laboratory. This is



Fuel-feeder Arrangements: Vacuum Exhauster on Floor

adequately equipped for carrying out all the testing requirements of a modern station: coal, water, oil, and so on. A particularly interesting piece of apparatus in this department is a special machine for determining the fineness of the powdered fuel. A series of sieve trays of different standard meshes is arranged one over the other progressively in order of fineness (coarse mesh at the top). A coal sample is put in the top tray and a horizontal arm operated by a small motor continually taps the top of the apparatus, so that the fuel falls through the sieves until it is arrested by a mesh too small to allow it to pass. The qualified chemist in charge of this department is proud of the fact that his "lab." is all-electric.

A word should be said about the station lighting; it is good. The turbine, control, and switch rooms are all equipped with "Holophane" units. In the turbine room there are eight heavy-duty intensive units equipped with 1,000-W lamps mounted immediately above the crane. The control room, a night photograph of which is reproduced on p. 541, is illuminated by three rows of extensive industrial units, about 50 in all, equipped with 200-W lamps and mounted at approximately 17.5 ft. above floor level. There are two lines of fittings with different capacity lamps in the switch room. Over the 1.5 million kVA switchgear intensive-type heavy-duty units with 500-W lamps are installed, and over the lower-capacity equipment extensive units with 300-W lamps are employed. Arrangements have been made for flood-lighting the building at night, a 500-W projector unit being arranged opposite each brick pier of the building and equipped with a rectangular lens, giving the effect of ribbons of light right up to the tops of the piers, see illustration on p. 541.

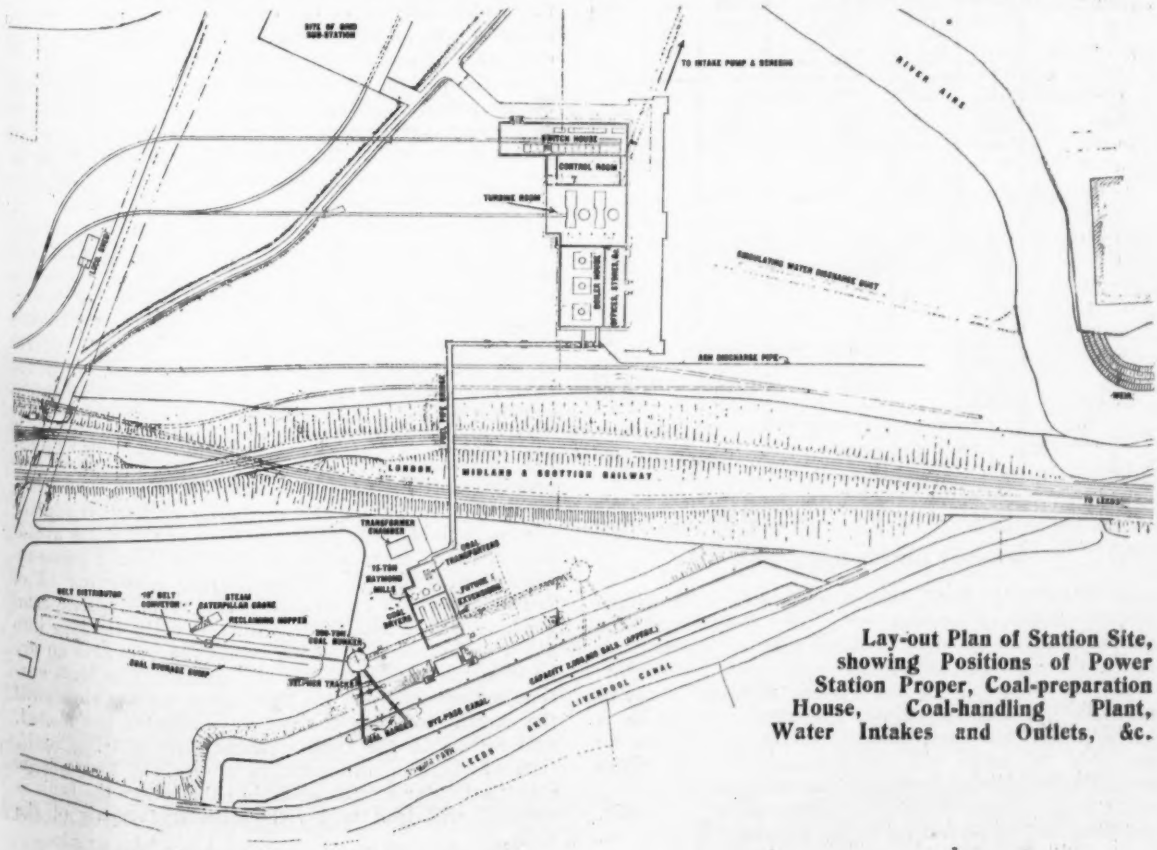
I.D. Fans and Control Gear

Arrangements have been made to facilitate extensions to the station in the future, the existing turbine room having a temporary end facing north-west. It is estimated that the total capital cost of the station when it is developed to its ultimate plant capacity will be £2,000,000. The capital cost of the initial section of the station, including the feeder switchgear, amounts to £780,000, or £15.6 per kW of plant installed.

Practically all the motors in the station were supplied by T. Harding Churton and Co., Ltd. The power-station buildings are carried on a substantial reinforced raft in which are incorporated the circulating-water intake and discharge ducts. The whole of the excavation and concrete work was executed by Harold Arnold & Son, Ltd. The steelwork is entirely of British manufacture and was supplied by Samuel Butler & Co., Ltd. The building work proper was carried out by Wm. Airey and Son (Leeds), Ltd., who had as the sub-contractor for the terra cotta work referred to earlier the Leeds Fireclay Co., Ltd.

The maximum load on the Leeds undertaking now exceeds over 64,000 kW, for an output of 150,000,000 kWh per annum, the annual load factor being in the neighbourhood of 27 per cent.

Our thanks are due to Mr. Hefford, who has been entirely responsible for the design and specification of the works, for permission to view the station and to take photographs, and to Mr. J. F. Sarvent, resident engineer at Kirkstall, and his assistant, Mr. T. R. Hoyle, and to Mr. E. O. Williams, technical assistant, for their help in the collection of the above information.



Lay-out Plan of Station Site, showing Positions of Power Station Proper, Coal-preparation House, Coal-handling Plant, Water Intakes and Outlets, &c.

An A.C. System of Distribution

Oil circuit breakers are installed in the power station only, adjacent sub-stations being supplied from different feeders

By J. P. HESLOP, Graduate I.E.E.

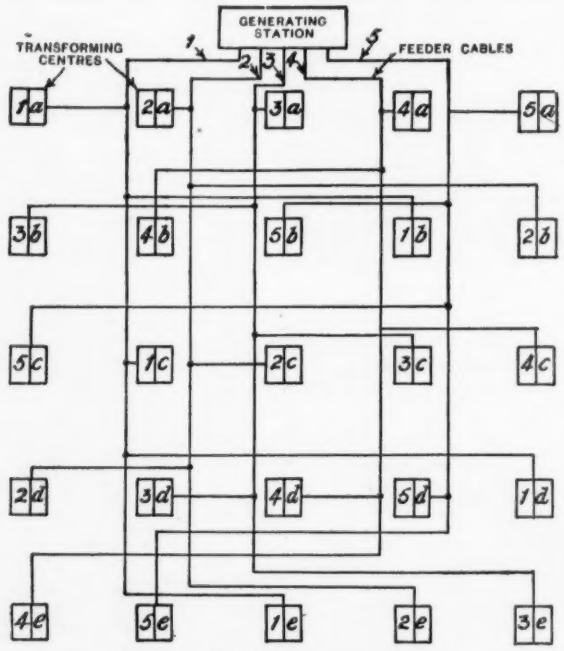
THE system described is claimed to possess the flexibility and economy of a.c. with the reliability of d.c. operation. Below is shown diagrammatically an area fed from a generating station by means of five h.p. feeders connected directly to the transformers sub-stations. The layout is a departure from the ring-main radial, and interconnected systems of feeders hitherto employed, in that the oil-circuit breakers are limited to the feeders leaving the generating station.

(1) *Feeders.*—No two adjacent sub-stations are connected to the same feeder. Reserve capacity will allow one feeder and its dependent transformers to be disconnected, by the oil-switch in the generating station and by the automatic secondary switches on the l.p. side. The amount of reserve feeder and transformer capacity is an inverse function of the number of feeders serving the area; in the present case five feeders will call for 20 per cent. reserve capacity.

In the generating station, current limiting reactors are provided on each feeder, and voltage regulators are most easily arranged on the bus-bar sections.

The absence of h.p. switchgear at the sub-stations allows, with this system, a higher economic voltage than is usually the case.

(2) *Transformers.*—The transformers employed in this system are designed with a reactance as high as from 7 to 10 per cent. in order to insure even distribution of load between sub-stations and also to limit, in certain instances, the fault current. An alternative method with lower-reactance transformers is to provide



Primary Distribution System

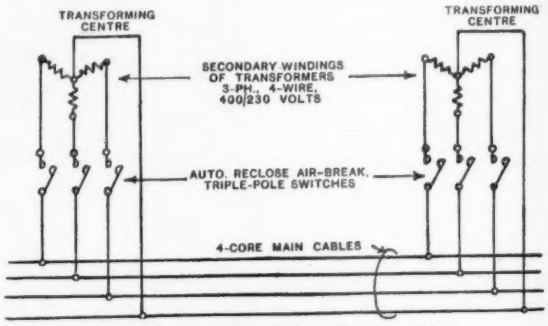
an external single-turn, iron-cored reactor in the transformer secondary neutral lead. For British use, the poorer voltage regulation entailed will perhaps militate against such a high transformer reactance as 10 per cent.

As the principle of the system involves the use of multiple l.p. feeding points, the number of which is increased as the load density increases, there is no tendency to make the transformer capacity above 800 kVA, which may be installed as a single unit.

(3) *Low-pressure Auxiliaries.*—The use of automatic, reclosing airbreak switches in the secondary is the great departure from standard practice, and was developed to avoid back feed from the mains under abnormal operating conditions. Each switch is connected directly to a transformer secondary on one side and to a secondary main cable on the other.

The connection of the switches to the secondary mains and to the transformers is shown by the smaller diagram. Their duties under various conditions of the system may best be described as follows :—

(*a*) To close the circuit between the transformer secondary and the low-pressure mains when the voltages


TRANSFORMING CENTRE
TRANSFORMING CENTRE
SECONDARY WINDINGS OF TRANSFORMERS 3-PH., 4-WIRE, 400/230 VOLTS
AUTO. RECLOSE AIR-BREAK, TRIPLE-POLE SWITCHES
4-CORE MAIN CABLES

Transformer Secondary Connections

of the secondary mains and the transformer are approximately in phase, and when the voltage of the latter exceeds the former sufficiently to cause forward power to flow. It will be noticed that this feature will not allow circuit closing if there exists a reversed phase, to achieve which the relay operating coils must be capable of withstanding double the phase voltage.

(*b*) To open the circuit in the event of a failure of the feeder cable or of the distribution transformer, in order to prevent power from the low-pressure mains and other sub-stations flowing into the fault.

(*c*) To open the circuit in the event of the opening of the generating station feeder switch or if power is cut off for any other reason. This feature requires that the switch shall open on the magnetising current of one or more transformers when supplied from the low-pressure secondary mains.

Special precautions are necessary in the characteristics of the relays to prevent the rapid opening and closing of the switches due to changes in the direction of the current, which can occur at times of low or uneven loadings in the area being fed. Also with feeders operating at the higher voltages, the charging current of the cable due to capacity reactance will, when fed from the secondary mains, lead the voltage to an extent sufficient to cause incorrect operation.

(4) *Low-pressure Mains.*—In existing systems employing this method of distribution, the secondary low-pressure network as a rule consists of single-core l.c. cables for the phases and a similar or bare conductor for the neutral. The primary object of this is the avoidance of faults between phases, limiting them to phase-to-neutral with the idea of facilitating a burning off of faults. The fault on a cable in this type of system commencing with a leak to the sheath rapidly develops into a low resistance path which eventually promotes an arc between the conductor and the sheath. The fault current consequent upon the starting of the arc rises until the sheath and then the copper conductor are melted, and results in the fault automatically clearing itself, thus avoiding an interruption to service. Low voltage in a particular stretch of main cable where the fault is situated will lead to investigation and repair of the cable.

Residential Heating

The Demand Made by Luminous Radiators in an All-electric House Creates an Economic Problem

By ALFRED EKSTROM, D.Sc., M.I E.E., and VIDAR EKSTROM

THE articles recently published in the lay Press regarding electricity prices show how deeply rooted is the public opinion that the result of the construction of the national supply system will be a substantial reduction in the price of electricity.

Since the Central Board will make a running charge of about 0.25d. per kWh, it should be possible to reduce the price to the consumer to about 0.5d. per kWh for all kinds of domestic consumption, provided that an adequate additional annual charge is made per domestic consumer to cover fixed costs. It will be of interest to consider how a two-part tariff, meeting the public desire for a low running charge, should be arranged. On the other hand, a price of about 1d. per kWh for cooking is quite a reasonable price if compared with the present price of gas in England. If, however, it is to be possible for the undertakings to supply energy on a large scale for heating water for the kitchen and for baths, it will be necessary to reduce the price of electricity for this purpose to about 0.5d. per kWh.

It would, of course, seem suitable to make only one running charge of, say, 0.5d. per kWh, whether the energy be used for lighting, cooking, water-heating, the heating of rooms, or any other purpose. We will investigate, in some typical practical examples of domestic consumption, the effect such a price would have on the additional fixed annual charge which would be necessary to give the supply undertaking a reasonable financial return. In all these examples we assume the following:—

1. The average consumer comprises five persons, having a house with six rooms.
2. The supply undertaking buys energy in bulk from a feeding centre belonging to the national supply system at a price of £3 10s. per maximum kW, plus 0.23d. per kWh.
3. The average energy losses in the distribution plant from the feeding centre to the average consumer are 25 per cent.
4. The annual cost for distribution is: Interest, 8 per cent.; depreciation, 3 per cent.; management and upkeep, 5 per cent., making a total of 16 per cent., all calculated on the initial cost of the distribution plant.

Example 1.—The distribution plant is assumed to be built for supplying an annual average consumption of 50 kWh per head for lighting and for sundry portable domestic appliances, such as irons and vacuum cleaners, *i.e.*, 250 kWh per consumer per annum at an average maximum demand of 0.25 kW. The plant is constructed for a maximum of from 0.25 to 0.50 kW per average consumer, involving an initial cost per consumer varying from £15 to £30. These figures accord with actual costs from 25 supply undertakings in England, where the industrial loads are practically negligible in comparison with the domestic loads. The lower figure is valid only for places where there is a great density of population and where conditions are very favourable for the construction of distribution lines.

Example 2.—The distribution plant is assumed to be built for the same purposes as in Example 1, plus about 350 kWh per person per annum for cooking, *i.e.*, a total of 2,000 kWh per consumer per annum, at an average maximum demand of 1 kW per person. The plant is constructed for a maximum of 1.0 to 1.25 kW per average consumer, involving an initial cost per consumer varying from £20 to £40.

Example 3.—The distribution plant is assumed to be built for the same purpose as in Example 2, plus 2,000 kWh per consumer per annum for water heating. This is sufficient to heat about 2 gallons of water per person daily from 50 to 185 deg. F., assuming a thermal storage system with an efficiency of 70 per cent. This quantity of water should meet the requirements of the average kitchen and scullery. We assume that of these 2,000 kWh, 1,500 will be consumed during the night. The annual day load of $5 \times 500 = 2{,}500$ kWh will make a maximum demand of 1.25 kW. The annual day and night consumption is 4,000 kWh.

The distribution plant is constructed for a maximum of 1.25 to 1.50 kW per consumer, involving an initial cost per consumer varying from £25 to £50.

Example 4.—The distribution plant is assumed to be built for the same purposes as in Example 3, plus an additional 3,000 kWh per annum for water heating for baths (one to two baths a day per consumer). We assume that of the 5,000 kWh consumed for water heating (2,000 for kitchen and scullery and 3,000 for baths), 4,000 can be produced during the night. The annual day consumption of 3,000 kWh will necessitate a maximum demand of 1.5 kW. The annual day and night consumption is 7,000 kWh.

The distribution plant is constructed for 1.5 to 2.0 kW, involving an initial cost per consumer varying from £30 to £60.

Example 5.—The distribution plant is assumed to be built for the same purpose as in Example 4, but it is also capable of supplying a day load of 3,000 kWh per consumer per annum for electric radiators for the entire

TABLE I.

—	Example I.	Example II.	Example III.	Example IV.	Example V.
1. kWh per annum taken by consumer	Day. $5 \times 50 = 250$	Day. $5(50+350) = 2{,}000$	Day — Night. $5(50+350+100+300) = 4{,}000$	Day — Night. $5(50+350+200+800) = 7{,}000$	Day — Night. $5(50+350+200+600+800) = 10{,}000$
2. Load-factor at main transf. centre...	0.116	0.23	0.37	0.54	0.154
3. Equiv. hours use of max. demand ...	1,000	2,000	3,200	4,667	1,333
4. kW of distribution plant per consumer	0.25 to 0.5	1.00 to 1.25	1.25 to 1.50	1.50 to 2.0	4.0 to 5.0
5. Capital cost of distribution plant ...	£ s. d. £ s. d. 15 0 0 30 0 0	£ s. d. £ s. d. 20 0 0 40 0 0	£ s. d. £ s. d. 25 0 0 50 0 0	£ s. d. £ s. d. 30 0 0 60 0 0	£ s. d. £ s. d. 60 0 0 120 0 0
6. Consumer's share of m.d. at feeding centre, kW, excl. energy losses	0.25	1.00	1.25	1.50	7.50
7. At £3 10s. per kW. plus 25% losses...	1 3 4 1 3 4	4 13 4 4 13 4	5 16 8 5 16 8	7 0 0 7 0 0	35 0 0 35 0 0
8. kWh at 0.23d. plus 25% losses ...	0 6 5 0 6 5	2 11 1 2 11 1	5 2 3 5 2 3	8 18 11 8 18 11	12 15 7 12 15 7
9. Distribution cost 16% of item 5 ...	2 8 0 4 16 0	3 4 0 6 8 0	4 0 0 8 0 0	4 16 0 9 12 0	9 12 0 19 4 0
10. Total cost	3 17 9 6 5 9	10 8 5 13 12 5	14 18 11 18 18 11	20 14 11 25 10 11	57 7 7 66 19 7
11. Running charge at ¼d. per kWh ...	0 10 5 0 10 5	4 3 4 4 3 4	8 6 8 8 6 8	14 11 8 14 11 8	20 16 8 20 16 8
12. Total fixed annual charge	3 7 4 5 15 4	6 5 1 9 9 1	6 12 3 10 12 3	6 3 3 10 19 3	36 10 11 46 2 11
13. Total fixed annual charge per room	0 11 3 0 19 3	1 0 10 1 11 6	1 2 0 1 15 4	1 0 6 1 16 6	6 1 10 7 13 8
14. Light, 250 kWh	3 17 9 6 5 9 (3.73d.) (6.04d.)	3 17 9 6 5 9 (3.73d.) (6.04d.)	3 17 9 6 5 9 (3.73d.) (6.04d.)	3 17 9 6 5 9 (3.73d.) (6.04d.)	3 17 9 6 5 9 (3.73d.) (6.04d.)
15. Cooking, 1,750 kWh	—	6 11 3 7 5 10 (0.9d.) (1.0d.)	6 11 3 7 5 10 (0.9d.) (1.0d.)	6 11 3 8 0 5 (0.9d.) (1.1d.)	7 5 10 8 0 5 (1.0d.) (1.1d.)
16. Water, 2,000 kWh for kitchen and scullery	—	—	4 3 4 5 0 0 (0.5d.) (0.6d.)	4 3 4 5 0 0 (0.5d.) (0.6d.)	5 6 0 5 0 0 (0.6d.) (0.6d.)
17. Water, 3,000 kWh for baths ...	—	—	—	6 5 0 6 5 0 (0.5d.) (0.6d.)	6 5 0 6 5 0 (0.5d.) (0.6d.)
18. Radiators, 3,000 kWh	—	—	—	—	34 17 6 41 7 6 (2.79d.) (3.31d.)
19. Totals	3 17 9 6 5 9	13 9 0 15 11 7	14 12 4 18 11 7	20 17 4 25 11 2	57 6 1 66 18 8
20. Average cost, pence per kWh ...	3.73 6.04	1.25 1.68	0.88 1.11	0.71 0.88	1.37 1.61
21. Running charge at 1d. per kWh day, and at 0.5d. per kWh night	1 0 10 1 0 10	8 6 8 8 6 8	13 10 10 13 10 10	20 16 8 20 16 8	33 6 8 33 6 8
22. Total fixed annual charge	2 16 11 5 4 11	2 1 9 5 5 9	1 8 1 5 8 1	— 4 14 3	24 0 11 33 12 11
23. Total fixed annual charge per room	0 9 6 0 17 6	0 6 11 0 17 7	0 4 8 0 18 0	— 0 15 8	4 0 2 5 13 2

heating of houses. It is assumed that for this purpose the maximum power demand will be increased by an additional 6 kW per consumer (corresponding to 500 hours use at maximum demand, or a load factor of 5.8 per cent.), or a total of 7.5 kW. The annual day and night consumption is 10,000 kWh.

We do not consider it necessary, however, to increase the capacity of the distribution plant to more than 4 to 5 kW per consumer, as in this case a larger drop of voltage can be allowed than in the previous examples. This involves an initial cost for the plant varying from £60 to £120 per consumer.

Conclusions.—It will be noted from Table I that under the conditions assumed in Examples 2, 3, and 4, a supply can be given with a two-part tariff at 0.5d. per kWh plus an additional annual charge of from about £1 to £1 16s. per room, but that in Example 5 the additional annual charge is as high as from £6 to £7 per room.

Examples 2 to 4 show that if the energy costs are divided into the different items—lighting and sundry portable domestic appliances, cooking, and water heating (mainly during off-peak load for the latter)—reasonable prices are obtained (items 14, 15, 16, and 17).

Example 5, item 18, shows that the prices resulting for heating are 2.85d. and 3.3d., which are obviously unreasonable.

As, for various reasons, however, it is very problematical whether such a high fixed annual charge can be obtained, we have made similar calculations in items 21, 22, and 23, assuming a running charge of 1d. per kWh for day load and 0.5d. for night load. We then find that the annual charge in Examples 1 to 4 is much reduced.

For practical purposes it would probably be more suitable to use the latter running charge in conjunction with an annual charge—dependent upon the local costs for distribution—of up to about 17s. per room (the average price is about 11s. in Examples 1 to 4.) Another alternative, of course, is to have a running charge of 0.5d. per kWh in the summer and 1d. in the winter. Even in this case, however, Example 5 shows an abnormally high fixed annual charge when radiators are used. This proves that, whereas it is an entirely sound financial proposition to give a supply on the ordinary two-part tariff for light, sundry portable domestic appliances, cooking, and water heating, it is not so in the case of a supply for heating rooms by luminous radiators in order to constitute an all-electric house.

A supply of energy for luminous radiators at a price of 1d. per kWh, or even less, often given in England, is a serious danger to the supply undertakings. Electric heating should not be allowed at such a price, except in conjunction with an adequate fixed annual charge per radiator, dependent upon the load of the radiator. We consider that supply undertakings should realise what steps are necessary for securing their position against the possible consequences of the heating load, especially when a bulk supply is taken from the national system on a two-part tariff.

Russian Timber

Points of Interest for Overhead-line Transmission Engineers

(COMMUNICATED)

THE timber resources of Russia (approximately 2,300 million acres), represent 27.9 per cent. of the world's resources. The organisation of forest economy is controlled by the Commissariat for Agriculture. Under the head "Agriculture" in the table of index figures in the Soviet Union Year Book for 1930, no mention is made of timber production. There are three items, "Industrial Crops," "Other Industrial Crops," and "Miscellaneous" which may include timber; the significant fact is that in each case the area worked is now double what it was in 1913, and about 30 per cent. higher than it was in 1927-29. The forests of the Caucasus contain about 19 million acres of timber of which 22 per cent. represents coniferous varieties. Of this amount 8 per cent. consists of pine and 6 per cent. of fir.

In 1913 the income from State-owned forests, which included more than half the forests in Russia, was 83 million roubles, and the total income may be assumed to be of the order of 160 million roubles. In 1923-24 the value of timber production in the Soviet Union at pre-war prices was 834 million roubles, and in 1928-29 no less than 1,287 million roubles. The income derived from these forests was 55 million roubles in 1923-24, rising to 303 million roubles in 1928-29. Figures for planting and rotation-periods are not given, but during the five years 1928-29 to 1932-33 the Soviet Union will invest 53 million roubles in the basic capital of national economy, and 14 million roubles in operating funds. The basic capital is to be increased 82 per cent., and 36 per cent. of the new capital investment (23,000 million roubles) is allotted to agriculture.

"Industrial crops" (unspecified) are to be increased, under the five-year plan, from the 1913 figure of 5.48 million hectares to 12 million hectares. The item "Miscellaneous crops" has increased from 8.5 million hectares in 1913 to 14.7 million hectares in 1929-30, but no figure is given for the five-year plan.

We may turn for further enlightenment to the tables showing output values of the principal State industries, showing "wood" outputs valued at 99 million roubles in 1925-26 and 187 million roubles in 1928-29 at 1913 prices. The capital investment in the State timber industry is here given as 29 million roubles for 1926-28, 74 million roubles for 1928-29, and no less than 200 million roubles for 1929-30, after which year no figures appear.

Concessions are granted to foreigners for various periods of time, in some cases 30 to 50 years, the Government guaranteeing immunity from nationalisation, confiscation, or requisition. In the case of timber concessions, it is usually stipulated that the concessionaire shall establish saw mills, &c. Under the heading "Openings for Concessions" is included the exploitation of about 7 million hectares of forest area. Enterprises not taken up by foreign concessionaires will be worked by the Soviet Government and it is possible that at the present time some of these areas are so worked.

Timber concessions worked in 1929 (since when no information is given) include one each for Great Britain, Japan, Poland, and Finland. Great Britain has 20 million roubles invested in Russian concessions, but the amount invested in the timber concern is not stated. For a total of 59 concessions of various kinds, the return to the concessionaires, in 1927-28, on their 1926-27 capital investment, works out at 95.9 per cent.

The railway transport returns show remarkable figures as regards timber. From 1913 to 1927 the annual weight of timber transported remained steady at approximately 12 million tons (presumably British tons). In 1927-28 this figure increased to 17 million and in 1928-29 to 21 million tons. There follows a list of 43 American concerns with whom "technical assistance" contracts have been concluded; British concerns are not mentioned, even anonymously.

Under the provisions of the five-year plan, exports from Russia are intended to increase to 165 per cent. in the five years. Forestry and mining products are to increase from 230 million roubles in 1927-28 to 678 million roubles in 1932-33, an increase ratio of 294 per cent.

In 1927-29 there were exported to this country from Russia 304,000 tons of "various timber" and 897,000 tons of sawn timber. One concludes that the intention is to treble these quantities by 1932-33.

A startling comparison of figures appears when we turn to the tables showing articles of export from Russia *via* all frontiers. "Poles of fir and pine" were exported in 1927-28 to a total of 837 tons, valued at 84 thousand roubles, an average of approximately 100 roubles per ton. In 1928-29, however, no less than 4,690 tons were exported valued at 91,000 roubles, giving an average of only 19 roubles per ton.

Suppose we consider that all these poles were 40 ft. long, 9 in. mean diameter, with a weight when creosoted of 855 lb. The weight of creosote, reckoning the timber at 32 lb. per cu. ft. weight and 5 lb. of creosote per cu. ft. retained, would be 134 lb. and the weight of the pole itself would therefore be 855−134=721 lb. This roughly gives three poles to the ton, and the value of one pole comes out at 6.3 roubles. The nominal quotation for the rouble to-day being 9.44 to £1= 2s. 1½d. approximately, the value of one pole is about 13s. 4d.

There are three organisations in London handling timber on behalf of the Soviet: Arcos, Ltd., White Sea Timber Trust, Ltd., and Russian Wood Agency, Ltd. The timber organisations sell about 10 per cent. of all Russian produce sold in this country. Great Britain has bought from Russia about £48,000,000 of timber materials since 1920, rising from £847,000 in 1921 to £9,878,000 in 1929. There appears to be no export duty of any kind on timber leaving Russia.

In 1928-29 agriculture and forestry together employed 2,138,000 persons and the timber industry 79,490. *The Times* Parliamentary Report, February 6th, 1931, gives us the information that about 2,000,000 people are now engaged in the Russian timber trade.

It certainly appears that Russia's five-year plan will enable her to supply timber to other countries in ever-increasing quantities and at ever-decreasing prices.

The "Monarch of Bermuda"

Launch of a Large Luxury Liner which is to be Steam Turbo-electrically Propelled

PRIMARILY intended for the New York-Bermuda service of Messrs. Furness, Withy & Co., Ltd., but designed to enable her to undertake long ocean cruises, the *Monarch of Bermuda* was launched at the High Walker-on-Tyne Navy Yard of Vickers-Armstrongs, Ltd., on March 17th. She is a quadruple-screw steam turbo-electrically driven ship 576 ft. long, 76 ft. 6 in. in breadth, has a speed of 20 knots, and is of some 20,500 tons.

Accommodation will be provided for 830 first-class passengers in single-berth, two-berth, and three-berth state rooms. One unique feature is the provision of a bathroom for each state room. Each cabin is tastefully decorated and provided with high-class furniture and fittings. Accommodation is also provided for thirty second-class passengers.

Lifts have been arranged to serve all decks, one at the forward end and two amidships. For handling cargo four 5-ton and one 15-ton derricks with electric winches around the foremast serve the hatches. At the after end electrically-operated cargo lifts are fitted with ship-side doors for transferring cargo to and from the vessel in accordance with American practice. A large windlass on the forecastle deck, with warping capstans forward, amidships, and at the after end, provides for quick manœuvring.

Electricity is to be used on an extensive scale throughout this ship. It is being adopted for the propulsion of the vessel, which involves the installation of several electrical machines of very heavy capacity. The contract for the electrical equipment was placed with the General Electric Co., Ltd.

The propulsion of the vessel will be effected by four motors, each driving a propellor shaft at a speed of 150 r.p.m. and each rated at 4,650 h.p. The power for these motors will be derived from two turbo-alternators each of which will have a capacity of 7,500 kW. Normally two motors will be supplied by each generator, but the control gear is being so designed as to afford great flexibility, so that there will be many ways of connecting up the individual motors and generators to suit special circumstances. The control equipment will ensure that the speed can be rapidly varied from dead slow to full by the manipulation of two large handwheels, and the direction of rotation of the propellors will be controlled by two small handwheels. The operation of the electrical equipment is to be on the simplest lines, and every possible provision is being made for the safety of operators by means of specially designed inter-locks.

In addition to the generators for propulsion, four 750-kW direct-current generators are to be installed for providing the necessary other electrical services of the ship. Each will run at a speed of 750 r.p.m., being driven through gearing by a steam turbine whose speed is 6,000 r.p.m. For maintaining a supply adequate for essential services in case of emergency an oil-engine-driven generator of 45 kW capacity is being installed on a deck well above the water line. An emergency steering motor supplied from a storage battery also forms a part of the equipment.

The main condensers are of the Weir regenerative twin type, each pair operating in parallel and bolted to a common exhaust orifice in the turbine casing. The total cooling surface is 20,000 sq. ft., sufficient to maintain a vacuum of 28 in. of mercury with a sea temperature of 85 deg. F.

The steam generating installation consists of eight oil-burning Babcock & Wilcox marine-type boilers, fitted with superheaters and tubular pre-airheaters arranged to work under the closed stokehold system of forced draught. Steam is to be generated at a pressure of 400 lb. per sq. in. and superheated to 650/675 deg. F. The total generating surface is about 42,260 sq. ft. and total superheater surface 17,840 sq. ft.; the total area of the air heaters is about 21,120 sq. ft. The auxiliary machinery includes two main and three auxiliary electrically-driven circulating pumps, and electrically-driven extraction pumps for the main and auxiliary closed-feed system. The main feed pumps are of the Weir turbo-driven type, with one standby steam-driven direct-acting Weir feed pump.

Surface feed heaters are to be fitted for raising the temperature of the feed water, comprising one intermediate and one high-pressure type, heating steam being taken from the auxiliary exhaust system and bled at suitable pressures from the main turbines. A boiler evaporating plant is provided comprising two high-pressure evaporators and distiller for general purposes, and one low-pressure evaporator for make-up feed purposes. The remaining auxiliaries are also to be electrically driven.

The whole of the usual services provided on the latest passenger luxury liners have been allowed for, and when completed the new vessel will be an excellent example of the combination of high-class and tasteful decoration, handsome appointments, comfort of furnishing, and the most up-to-date machinery and equipment that makes for prompt and pleasing service afloat.

Central Argentine Railway

The Progress of Extensions to the System of a British-owned Foreign Railway

(COMMUNICATED)

AS a result of the satisfactory results obtained from the electrification of one of the three suburban lines of the Central Argentine Railway, the two other lines are now being converted. It is expected that an electric service will be run over the whole suburban system of 52 route miles by the middle of the present year.

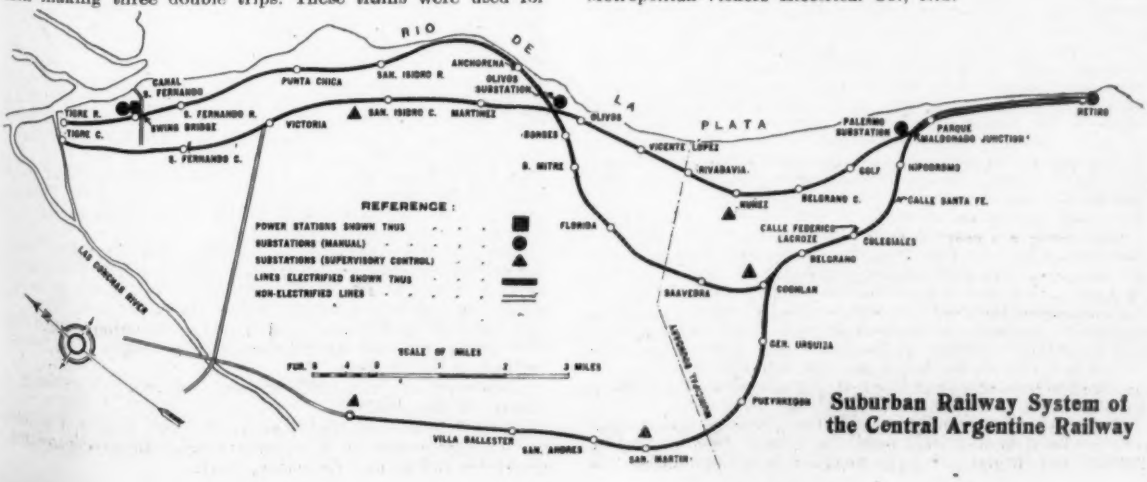
The original scheme covered about 18 route miles between Retiro and Tigre (C) indicated on the plan reproduced below; since its inception in 1916 passenger traffic on the system has grown from 5½ to 20 millions per annum.

The electrification of the Retiro-Tigre (R) line is now ready for traffic as far as Borges; the arrival of the first electric train at the latter (on December 18th last) is illustrated on page 558 of this issue.

Since that date a trial service without passengers has been run to Borges every week-day afternoon by two train sets, each making three double trips. These trains were used for instructing the motormen in the signals and familiarising them with the new route generally.

Arrangements were made to commence a passenger service to Borges from the middle of January with two train sets. These will not be sufficient to run all the Borges service electrically, but are all that can for the time being be worked into the train-movement programme. This is because most of the steam-train sets on the suburban service made several trips each day to Tigre (R) and Villa Ballester in addition to the Borges service, and for the present it is only possible to replace two of these sets pending the opening of the branch line as far as Tigre (R).

The track equipment is laid out on the third-rail principle, energy being supplied at 800 volts d.c., from four manual and five supervisory-control sub-stations. All the plant is of British manufacture, the principal electrical contractors being the Metropolitan-Vickers Electrical Co., Ltd.



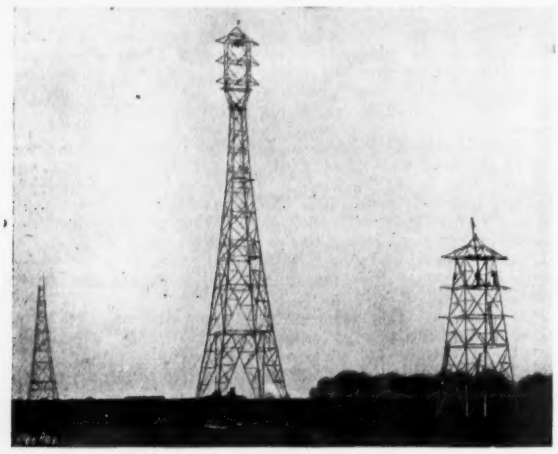
Suburban Railway System of the Central Argentine Railway

The Work of the C.E.B.

The eight schemes adopted cover 71.8 per cent. of the area of Great Britain, 97.6 per cent. of the population, and 99.4 per cent. of the output of electricity by authorised undertakings

THE third annual report of the Central Electricity Board, relating to the calendar year 1930, has been issued during the present week (Whitehead Morris, Ltd., Tower House, Holland Street, London, S.E.1, 5s.). As in previous reports, the procedure under which the Board's operations are set in motion are conveniently recapitulated. With the one exception of the North of Scotland, which contains less than two per cent. of the population of Great Britain, schemes are now in hand for the extension of the grid throughout the country. Arrangements have, however, been made with the owners of the Grampian water power undertaking in the North of Scotland, which anticipate in some measure the work of co-ordination and interconnection in that area.

Greatly accelerated progress has been made in obtaining wayleaves, 1,000 miles having been settled in the twelve months, and the help given by landowners, public authorities, and societies concerned with rural amenities, is acknowledged. Difficulty in negotiating wayleaves is, however, still being



The River Witham Crossing

experienced in South-east England, particularly in the built-up areas near London, where it has been necessary to apply for compulsory powers in two cases. Actual acquaintance with the physical aspects of the grid is, however, quickly breaking down prejudice. A form of consent for the erection of lines on farm lands has been settled with the Farmers' Union.

Contracts for the three schemes adopted were placed to the amount of £7,368,137, bringing the total value to date of contracts for the grid construction up to £18,267,829, all of which have been given to British firms. The South-East England Area has accounted for nearly 40 per cent. of the total. The expenditure on main transmission lines and transforming stations has been about £13¼ million and on the secondary system about £4¼ million. Work completed during the year includes 600 miles of line, bringing the total to 900 miles, of which 500 miles is in commission.

Standardisation of frequency is proceeding, the changeovers being carried out by the undertakings affected in whole-hearted collaboration with the Board. Arrangements were made to spend a further sum of £9,969,550 during the next few years, bringing the total sum allocated to frequency standardisation (mostly in North-East England, Central England, and Central Scotland) to £18,539,450, of which North-East England will require £9,065,100. The present estimate of the total cost of frequency standardisation in the country, based upon experience gained in Central Scotland and Central England, is in round figures £19,000,000 gross and £16,300,000 net; the difference between the gross and net figures represents sums to be recovered from undertakings for plant required for normal development which has been installed at earlier dates to facilitate standardisation. The installation of new or altered electrical plant on consumers' premises will contribute to the work of modernisation of some of the most important industries in the country. It has been found that the most economical method of dealing with the 25-cycle Deptford (East) selected station will be to restrict the non-standard supply to that required by the Southern Railway, altering the remainder of the plant for 50-cycle operation. One-half of the cost only (£100,000) will be contributed by the C.E.B. The original scheme was to install frequency changers. Frequency changers (50 to 40 cycles) will, however, be used at the Tame Valley station of the Stalybridge Electricity Board, whose new Hartshead station will operate at 50 cycles.

The operating characteristics of the grid having proved to be in accordance with pre-calculated figures, it is not proposed to make any alterations in basic design. Steel-cored aluminium conductors with circular strands have been used on all lines constructed during 1930, but a modified type of conductor with sector-shaped aluminium strands is being tested. This design reduces the overall diameter of the conductor, and consequently the wind and ice loading also. The tendency to decrease in critical corona voltage is, however, counteracted by the smooth surface. The new conductor is claimed to have an additional advantage in resistance to corrosion. New types of conductor clamps are being developed and it is anticipated that they will be available for the remaining sections of the grid. So far there has been no justification for adopting reinforced concrete or wood in place of the lattice steel towers.

Experience in Scotland has shown the desirability of adjusting the insulation of overhead lines in accordance with atmospheric conditions. The normal 132-kV suspension insulator consists of nine units, but in the neighbourhood of large cities eleven units may be required. In North-East England the risk of interference with supply due to salt-laden atmosphere has caused an alteration of the proposed run of the principal main transmission lines to a route further inland, with a consequential revision of the generating-plant extension programme. The Board is collaborating with the National Physical Laboratory in determining the factor of safety of line insulation requisite in the combination of fog and atmospheric pollution peculiar to the British Isles.

An interesting development in the detail design of discriminative protective gear has been completed in the course of the year, whereby potential supplies for distance relays can be taken directly from the 132-kV system. This method will improve accuracy, reduce maintenance costs, and enable comparatively small supplies to be economicallly obtained direct from the transmission lines.

Dealing with individual areas, the Report states that the actual cost of the grid system in Central Scotland is now closely ascertainable and a tariff for the area is in preparation.

In South-East England the growth of the demand for electricity has made it necessary for the Board to ante-date the construction of sections of the grid to afford temporary supplies to 17 undertakings (8 through the J.E.A.), making the total number of such temporary arrangements 30 in all parts of the country. Negotiations with the Corporations of Brighton

Islington 66-kV Sub-station

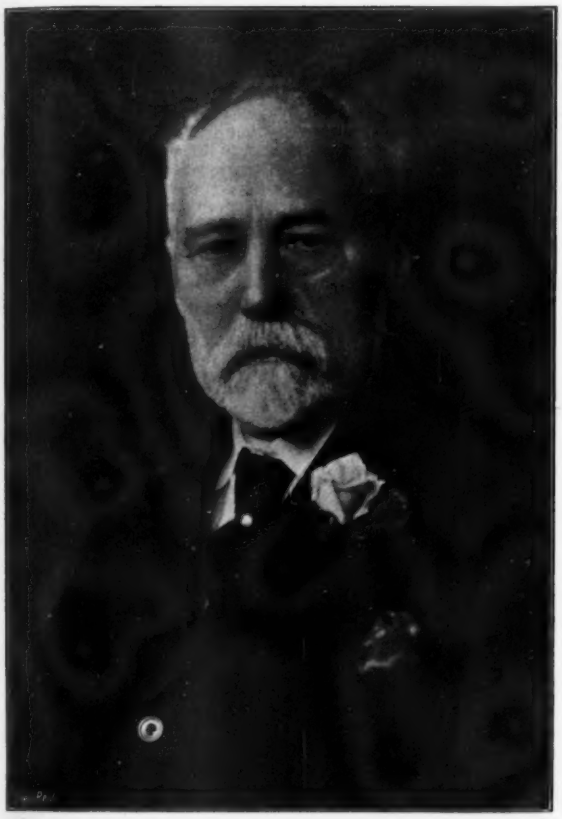
and Croydon have been concluded for the electrification of the Southern Railway from Purley to Brighton and Worthing. The most extensive 132-kV transforming station on the grid is that at Swanscombe, which is designed to control nine outgoing lines. A portion of the first of the main transforming stations in the London area to be completed (Islington) is illustrated above. A considerable portion of the first experimental 132-kV cable has been laid between Deptford and Eltham; some delay has been caused by difficulties in the purchase of suitable sites for the oil-feed and pressure tanks.

In the Mid-East England Area, a noteworthy piece of work has been the carrying of a 33-kV line over the River Witham at Boston by means of towers 230 ft. high, giving a clearance over high-water level of 150 ft.

Owing to the rapid electrical development since 1924 when the original estimate of £8¼ million as the net cost of frequency standardisation was made, the now estimated figure, as shown above, is about £16,300,000 net. Added to the figure of £25 million, the estimated cost of grid construction in the first five years, the total expenditure will be nearly £50 million instead of £33¼ million.

The report is well produced and printed. It contains a dozen plates showing various features of constructional interest, a map of the main grid and maps of N.E. England, S.W. England and S. Wales, and East England, and several statistical tables.

Francis Henry Nalder



Swaine] [London.

The late Mr. F. H. Nalder

MR. F. H. NALDER, who passed away on Monday morning last in his seventy-second year, was for many years one of the leading men in the electrical industry.

When writing concerning his career, in the ELECTRICAL REVIEW for April 30th, 1926, we wondered how many men there were amongst us who could "look back upon a record of nearly forty-two years' active connection with British electrical manufacturing in a business operating under their own name." Five more years have since elapsed, but during at least the last of these Mr. Nalder was a great sufferer, and was prevented from actively pursuing his former interests; he had, indeed, been confined to his bed for more than a year.

We have to express feelings of deep regret, which we are sure will be shared by many of our readers, at the severance of another of the all too few remaining links with the early days of the industry.

When we last wrote about him Mr. Nalder was managing director and chairman of Messrs. Nalder Bros. & Thompson, Ltd.; recently he was honorary chairman of the company, with Mr. A. F. Harris, M.I.E.E., as managing director. Mr. Nalder's second son, Mr. D. W. Nalder, is engaged with the company.

The foundation of the business dates from the end of the year 1884 when Mr. Francis Nalder, joining hands with Mr. H. Nalder, his brother, commenced electrical manufacturing operations, opening a small works at Brentford for that purpose. Again and again the works were extended as the business was one of continuous development; he was joined by other partners; and in the course of progress the factories were moved, until finally, in 1914, as leases fell in, there was a removal to the present headquarters at Dalston Lane, London, where, ever since, the large-scale production of high-class electrical instruments has been carried on.

Mr. Nalder devoted much time and thought to the general well-being and organisation of the electrical industry twenty-five years ago; especially in 1905 and onwards was this the case, when the National Electrical Manufacturers' Association was cutting new ground. When that organisation developed into the B.E.A.M.A., he was its first chairman, and continued as a member of the Council for many years. He was a member of the I.E.E., and was also interested in various technical institutes. He was chairman of Oertlings, Ltd., chemical balance and scientific instrument makers; an original member of the Engineers' Club; and was also a prominent Freemason.

Mr. Nalder passed away at his residence, Coniston, Foxgrove Road, Beckenham. The funeral takes place to-day, Friday, at 3 p.m., at Wandsworth Cemetery, Magdalen Road.

The National Register

Mr. Hunter Addresses Scottish Contractors

Mr. P. V. Hunter, C.B.E., in his capacity of chairman of the executive of the National Register of Electrical Installation Contractors, recently visited Scotland and addressed three meetings on the subject of the Register. At the first gathering of contractors which was held in Glasgow on March 19th, Major Herbert Bell, the city electrical engineer, and other members of the Local Advisory Committees from Glasgow, Aberdeen, Dundee and Edinburgh, were present, as were also Mr. D. H. Morris and the entire central board of the Electrical Contractors' Association of Scotland. Mr. D. S. Munro, the Scottish representative on the executive of the register, introduced Mr. P. V. Hunter as the sincere supporter of contractors' interests and as the hard-working leader of the executive since its inception some seven years ago. Mr. Hunter explained that he had come north to remove any misconceptions about the working of the Register and to ascertain the reasons which so far had prevented it from being so popular and useful as it had proved in England. He stated that the question of the inspection of wiring work was now seriously exercising the minds of his committee. At the close of his remarks he answered a number of questions regarding the Register.

The second meeting was held at a later hour on the same day and Major Herbert Bell presided over a large gathering of contractors, registered and unregistered. After "high tea," Mr. Hunter gave an address on the "Aims and Progress of the Register." In the course of his address he indicated that he was not satisfied that the 94 registered firms in Scotland represented adequately the proportion of fully qualified contractors and that he and his executive were willing to go far to meet any scheme which Scotland might consider would further the local usefulness of the Register. Among those who took part in the discussion which followed the address were Messrs. A. Ure, A. Lindsay, A. Milne, and Watson, all of Glasgow; Mr. Yuille, of Kilmarnock; and Mr. Macmoreland, of Greenock. The vote of thanks to Mr. Hunter was proposed by Mr. Walter Finlay, W.S. of Edinburgh.

The last meeting of the series was held in Edinburgh on March 20th, with Mr. A. Pratt in the chair. Mr. Edwin Seddon, the city electrical engineer, and other members of the Scottish Advisory Committees, were present. The chairman at the outset frankly expressed his distaste for the Register as at present controlled from London. Mr. P. V. Hunter, quite undaunted by this half-chaffingly expressed opinion, proceeded with his remarks on the Register. He said that it must necessarily be of small service in Scotland if even a small proportion of the good contracting firms remained outside the circle and were hostile to it. At this comparatively small meeting the chairman invited everyone present to give some expression of their personal experience of the Register, and for the most part these indicated that little or no direct benefit to business had resulted through its operations. General opinion, however, was favourable to the formation of a Scottish Committee by which matters of local importance in practice could be dealt with and which would have some powers in connection with admission and discipline. Mr. Hunter considered that such a body, if formed, would at the lowest have the definite value of keeping the Register to the forefront and so in time would bring in those people who were at present delaying its usefulness in Scotland.

B.E.A.M.A

The Annual Meeting

Mr. J. A. Hirst (Brookhirst Switchgear, Ltd), deputy chairman, presided at the annual meeting of the B.E.A.M.A. held on March 19th, at 36, Kingsway, London. He referred to the deaths since the last meeting of distinguished vice-presidents and others mentioned in our "Personal" column last week. The speaker then proceeded to deal with the accounts, and with the report of the Council (ELEC. REV., March 20th, p. 509), mentioning the good work done by the main departments. The report was a highly condensed summary of this work; it left unreported a multitude of other business matters. The Legal Department was steadily progressive, and the Statistical Department was very active. In his closing words, Mr. Hirst remarked with pleasure that, in spite of the difficult times, there was clear evidence of a strong desire to co-operate on the part of members who had shown some reluctance to do so in the past. The following members were elected to the Council for the Session: Berry's Electric, Ltd., British Thompson-Houston Co., Ltd., Brookhirst Switchgear, Ltd., Crossley Brothers, Ltd., English Electric Co., Ltd., W. T. Glover and Co., Ltd., and Mirrlees, Watson Co., Ltd.

At the subsequent meeting of the Council, Mr. V. Watlington, M.B.E., who is in Buenos Aires in connection with the Exhibition, was unanimously re-elected Chairman for the session 1931/2.

D

Business and Industrial Notes

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

The Easter Holidays.

Our Advertisement Department asks us to state that owing to the incidence of the Easter holidays next week new copy and blocks for displayed advertisements for our April 10th issue should be received by Monday next, March 30th. Official notices and small prepaid advertisements for the April 3rd issue can be taken up to 5 p.m. on March 30th.

Municipalities and British Plant

At the luncheon given by the Batti-Wallahs' Society on March 18th, at the Hotel Metropole, London, W.C., Sir William Ray, L.C.C., stated his belief that a strong impetus would be given to the restoration of industrial prosperity if municipalities, as a whole, followed the example of the L.C.C. in purchasing British goods in all cases, provided the British manufacturers dealt fairly by them. A mutual understanding could be obtained only by conferences between the parties. The manufacturers generally could be made to see the value of the market at their own doors which existed in the requirements of local authorities. The L.C.C. bought 150,000 electric lamps each year—all British. In several recent contracts the difference between British and foreign tenders was of the order of 2 per cent. As an illustration, he referred to the contract for Lambeth Bridge. By purchasing steel and granite abroad £20,000 could have been saved out of a total of £700,000, but £50,000 per annum would have been paid in unemployment relief. The policy adopted by the L.C.C., on the other hand, would enable 1,000 workmen to preserve their self-respect by earning £170,000 for one year; it would also help to keep furnaces in blast and the industries affected as going concerns, and would bestow all the advantages of keeping money in circulation. He considered that no economic theories should be allowed to stand in the way of improving conditions. Referring to the financial impoverishment of some of the smaller municipalities, he suggested that the Government should "go 50-50" in the difference between British and foreign goods. Mr. Wm. McLelland, C.B., O.B.E., president, occupied the chair, and the vote of thanks to Sir Wm. Ray was moved by Mr. W. E. Lang.

Dutch Electrical Imports and Exports

The Dutch official trade returns for the past year, which have just been issued, show that despite the world trade depression, imports into Holland showed an increase of £216,670, or nearly 4 per cent., the total being £5,828,831. It is seen that the bulk of the imports are supplied by Germany, although there was a decrease in Dutch imports of German electrical machinery. On the other hand, it is satisfactory to find Great Britain in the second place with an increase of nearly 100 per cent. Increases were also recorded in the imports of British telephone and telegraph material, radio goods, insulated wires and cables, and miscellaneous electrical apparatus. Imports of British electric lamps declined, while no supplies are recorded in the case of vacuum cleaners and bare copper and bronze wire. The Dutch electrical exports again exceeded the imports, but the trade was lower in 1930 than in the preceding year to the extent of £1,472,500, or about 14 per cent., the total being £8,924,581. Unfortunately the Dutch official returns are not so informative on the export side as they are as regards imports. It is remarkable that while detailed information is given regarding the distribution of several relatively small items, no corresponding information is given in relation to the two important items of radio material and lamps, which form by far the major portion of the Dutch shipments.

Belgian Foreign Electrical Trade

The official returns of Belgium's electrical imports and exports during 1930 show that there was an increase in both directions. The total value of imports was £4,470,219, as compared with £3,449,082 in 1929. Electrical machinery was imported mainly from Germany, France, Sweden, and Switzerland; Great Britain's quota was £50,709. Great Britain assumed the first place as supplier of accumulators and parts, the value being £11,989, France supplying goods to the value of £11,955. Germany was the principal supplier of the following classes of goods: Land and submarine cables, £223,052; insulated wires, £81,983 (Great Britain, £9,989); telegraph and telephone apparatus, £175,737 (Holland £164,075, Great Britain £49,880); and "other electrical apparatus," £664,097 (France £383,137, Great Britain £112,800). The export total rose from £2,057,944 to £2,379,725. Holland (£52,497) was the principal customer for electrical machinery; Great Britain's share had a value of £10,360. This country was the principal importer of Belgian land and submarine cables, being responsible for £146,235 of a total of £337,440, as well as for insulated wires, £83,085, of a total of £305,480. Spain, Holland and Switzerland were the largest importers of Belgian telegraph and telephone apparatus; Great Britain's share was £49,475. This country took only a small proportion of the exports of "other electrical apparatus," £3,366, out of a total of £256,389.

London Electricians' Strike

We reported in our issue of March 13th that in consequence of a strike of electricians employed on the construction of the new Ford factory at Dagenham, the National Federated Electrical Association had decided to withhold the payment of the temporary addition of 5 per cent. which has been paid to electricians in the London area for some time. The Electrical Trades Union stated that it regarded this as a lock-out threat, and maintained that the Association had no justification for penalising London members of the Union for something with which they were not concerned. It was also stated that the matter should have been referred to the National Joint Industrial Council for the industry. In the absence of any further statement by the N.F.E.A., a strike was called throughout the London area last week, and by Monday last all work on a number of important contracts had ceased. The secretary of the N.F.E.A., Mr. L. C. Penwill, stated on Monday that the temporary addition was contingent upon the observance of existing agreements by the E.T.U. The latter had refused to refer the Ford dispute to arbitration and had taken strike action not only in the case of the Ford contract but in two adjacent contracts in the London area. He maintained that the withdrawal of the temporary addition did not represent a wage cut; basic wages were fixed by national agreement and were not affected.

Wages in the Contracting Industry

In the course of an article in which the levels of rates of wages in August, 1914, and December, 1930, are compared, the *Ministry of Labour Gazette* shows that the average of the recognised time rates of wages of wiremen employed by electrical contractors in twelve of the largest towns at the end of December, 1930, was 75s. 3d. a week, compared with 39s. 4d. a week at August, 1914, showing an average increase of 91 per cent. As the normal weekly hours of labour, which were usually 53 or 54 in 1914, were reduced to 47 in 1919, without any reduction in weekly wages, the increase in hourly rates since 1914 is greater, being about 113 per cent.

Irish Free State Electrical Imports

The appended table shows the value of the electrical machinery and apparatus imported into the Irish Free State during January last, as compared with the first month of 1930. Of the six items scheduled, only two show an increase. In the aggregate the month's imports represent a falling off of £2,099.

	January. 1930.	1931.
Electrical machinery	17,552	15,734
Electric wires and cables	10,802	11,498
Electric lamps and parts	7,662	5,615
Wireless sets and parts	16,602	12,319
Other electrical goods	14,969	20,519
Copper wire	842	649
Totals	£68,429	£66,330

American Activity in Rumania

It is reported that the American Electric Bond and Share Corporation has signed a contract with the Rumanian Government involving the sum of $200,000,000 (£40,000,000) including an immediate loan of $10,000,000 to the city of Bucharest. It is planned first to take over the electrical services of the Corporation of Bucharest and then to run the electric power industry of the whole country, thus following in the footsteps of the International Telephone and Telegraph Corporation, which now controls all the telephone services in the country.—*Reuter* (Bucharest).

Lift Companies Amalgamate

The amalgamation of the Express Lift Co., Ltd., and Smith, Major & Stevens, Ltd., is announced. The directors state that the territorial activities of the two companies were rarely in conflict, and the increased strength obtainable by unity in provincial centres and overseas markets will have a favourable reaction economically, and will make for increasingly efficient service. The amalgamation will trade under the name of "The Express Lift Co., Ltd., with which is incorporated Smith, Major & Stevens, Ltd.," and the board will comprise all the past directors. The headquarters will be at Greycoat Street, Westminster, S.W.1. The Northampton works is being further extended, and when the extension is complete the whole of the products of the united companies will be manufactured in the one works. All classes and types of lifts will be manufactured, and an improved type of moving stairway is being introduced; this will be known as "Glydeways," and will be all-British in design and manufacture.

Dutch Patent Extension Proposed

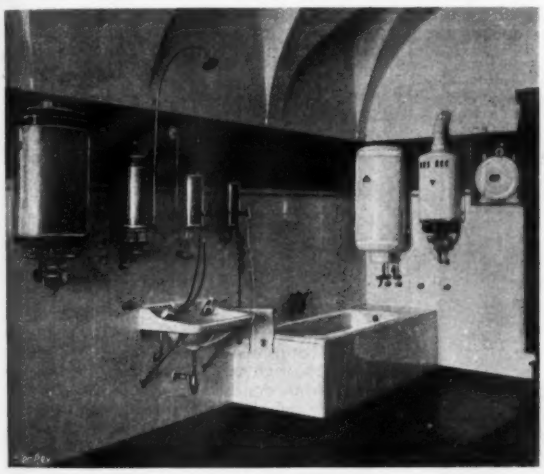
The Second Chamber of the Netherlands States-General has adopted a Bill providing for the extension of Dutch patents from 15 to 18 years. In particular it is said that the extension will be of advantage to a Philips gas-filling patent which otherwise would have expired in 1932. The Bill still requires the endorsement of the First Chamber.

Employment during February

The March *Ministry of Labour Gazette* states that employment in the engineering industry remained bad, on the whole, in February and showed a general decline. In electrical engineering, employment, though slack and declining, was much better than in other sections. A total of 241,621 unemployed was recorded for the engineering industry on February 23rd, the proportion thus rising from 22.2 to 23.8 per cent. The number of unemployed in the electrical engineering section was 13,149 or 14.6 per cent. (against 13.9 per cent.). The electric cable, wire and lamp manufacturing group reported 14,527 unemployed or 14.2 per cent. (against 12.9 per cent.). The proportion of unemployed in the electrical wiring and contracting industry rose from 13.6 to 14.4 per cent., the total being 2,658.

Domestic Development in Italy

In a recent article upon the possibilities of selling British domestic electrical appliances in Italy (ELEC. REV., March 6th, p. 439) we included views of typical Italian showrooms. We have now received photographs of the headquarters of the Società Industriale Trentino, of Trento. These show that the company is fully alive to the advantages of display. The showrooms are attractively arranged, containing examples of all



An Italian Water-heating Display

kinds of domestic appliances, and well lighted. One section of the showrooms, that devoted to water-heating apparatus, is particularly good, as will be seen from the reproduction which accompanies these notes. The company has a well-trained showroom staff capable of explaining and demonstrating the appliances, and a special tariff for domestic purposes encourages development in this town of 70,000 people.

Bankruptcy Proceedings

G. H. HANSEN, 50, Park Road, Peterborough, Northants., electrical engineer.—The public examination of this debtor was held recently at the Law Courts, Peterborough. The statement of affairs showed ranking liabilities of £372 and assets of £8. Among other causes, the failure was attributed to keen competition, loss of business during the war, &c. The debtor started trading in 1900 with a capital of £15 and was successful for some time, but the war almost broke up his trade. After the war, when there was a boom, he had not sufficient capital to compete with others. He obtained Corporation contracts but lost over them. He said that he became aware of his position some years ago. The hearing was adjourned for closing.

J. G. ROGER, Butter Market Chambers, Butter Market, Ipswich, Suffolk, wireless engineer.—The first meeting of creditors was held on March 17th at Ipswich, when a statement of affairs was submitted showing ranking liabilities of £1,142, against net assets of £354. The matter was left in the hands of Mr. C. L. Nankivell, who was appointed trustee.

W. C. HANNAH, 2, Percy Street, Hull, electrical engineer.—The first meeting of creditors herein was held on March 20th at the Official Receiver's office, 37, Scale Lane, Hull. According to the statement of affairs submitted there were liabilities of £261 and assets of £108. The debtor said that his position was due to the illness of himself and of his late wife, insufficient capital, &c. The matter remains in the hands of the Official Receiver as trustee.

S. E. RICHARDS and A. K. NEILSON, trading as Richards and Neilson, wireless and electrical engineers, 182, Tulse Hill, S.W.—This firm failed last May and an application was made on March 17th to Mr. Registrar Mellor at the London Bankruptcy Court for an order of discharge on behalf of the bankrupts. The Official Receiver reported that the ranking liabilities amounted to £554 and the assets to less than £2. The failure was attributed to lack of capital, bad trade and liability on certain promissory notes given to a former partner on retirement. The discharge of both debtors was granted subject to a suspension of three months.

HENRY GARDE, electrical accessory manufacturer, 175, Great Portland Street, W.—The affairs of this debtor came before Mr. Registrar Warmington on March 19th at the London Bankruptcy Court. He failed in 1924, with ranking liabilities of £3,369, against assets of £51, and on October 30th last he was granted an order of discharge subject to judgment for £50. Mr. E. Parke now reported that the debtor had informed him that he was unable to satisfy the judgment, and it was therefore necessary to make a fresh order. After hearing the debtor, his Honour suspended the discharge for six months, to date from October 30th, 1930, when the application was originally before the Court.

H. E. SANDELL, electrical engineer, 1, Sandpit Lane, St. Albans.—First meeting held March 24th. Public examination, April 22nd at the Court House, St. Albans.

W. A. BEAUMONT, electrical engineer, 44, Warrengate, Wakefield.—Last day for receiving proofs for dividend, April 4th. Trustee, Mr. B. S. Briggs, 13, Burton Street, Wakefield, Official Receiver.

Company Liquidations

NEWCASTLE EMLYN & DISTRICT ELECTRIC SUPPLY CO., LTD.—Winding up voluntarily. Liquidator, Mr. J. W. Davies, Central House, Kingsway, W.C.

GRAPHONES, LTD.—Winding up voluntarily. Joint liquidators, Mr. J. W. Williams, 5, St. Andrew's Crescent, Cardiff, and Mr. J. S. Bradley Hole, 240, High Holborn, W.C., with a committee of inspection.—Particulars of claims by April 30th to the liquidators.

STANDARD ELECTRIC CO., LTD.—Meetings April 20th at 190, West George Street, Glasgow, to receive an account of the winding up of the company.

COOK'S WIRELESS CO., LTD.—Meeting, April 21st at 30, Museum Street, Ipswich, to receive an account of the winding up of the company.

IMPERIAL TRAMWAYS CO., LTD.—Meeting, April 24th, at 71, Queen Street, E.C.4, to receive an account of the winding up of the company.

Meetings of Creditors

J. & P. WIRELESS SERVICES, LTD.—Creditors' meeting, March 27th, at 73-75, Albion Street, Leeds.

ALDWYCH ELECTRICAL CO., LTD.—Meeting of creditors, March 30th, at 40-43, Norfolk Street, W.C.2.

WORSNOP & CO., LTD.—Creditors' meeting, March 31st, at 5, Rawson Street, Halifax.

New Showrooms and Offices

With practically no industrial load, the electricity department of Bexley Urban District Council, under the supervision of Mr. A. J. Abraham, engineer and general manager, concentrates on development in the domestic sphere, and with the rapid growth of the district and the consequent increased consumption of electricity, the old showrooms, which were leased, proved inadequate and new showrooms and offices were opened on March 18th on a site adjoining the sub-station. The new premises, although not centrally situated, are in an admirable position as they are surrounded by new houses and houses in course of construction. The showrooms have extensive display windows on two sides of the building and contain an excellent display of all the electrical appliances which are conducive to comfort and cleanliness in the home. At the rear of the showrooms are the stores, while on the floor above are the spacious offices, most of which are warmed by tubular heaters. The contract rate is the most popular tariff, over half of the domestic consumers taking a supply under this system. The charge is 1s. 8d. per quarter for each 50 watts installed for lighting purposes only, plus ¾d. per kWh for electricity consumed for lighting, heating, small power, &c.

The Business Efficiency Exhibition.

This annual exhibition, organised by the Office Appliance Trades Association, was opened at the White City on March 17th: it closed yesterday (Thursday). Each year sees a further advance in the use of electricity in commercial offices and again there were additions to the number of electrically-operated appliances on exhibition. These included tabulating and accounting machines, typewriters, dictaphones, addressing machines, time recorders, &c. Intercommunication systems were shown by the Reliance Telephone Co., Ltd., the British Home & Office Telephone Co., Ltd., and Dictograph Telephones, Ltd. The Typerlite Co. exhibited various examples of its fittings for desk-lighting, &c.

Czecho-Slovakian Electrical Imports

Trade in electrical machinery and apparatus is one of the few branches in which Czecho-Slovakia's imports are unduly large compared with exports. In 1930, Czecho-Slovakia imported these classes of goods to the total value of 327 million crowns (nearly £2,000,000), while the value of the exports was not quite 95 millions (£580,000). Imports of dynamos, generators and transformers accounted for 63 million kr.; telegraph, telephone and radio apparatus for 95 millions; incandescent and arc lamps for 40 millions; and meters, &c., for 23 millions.

Wages in the Cable-making Industry

The Joint Industrial Council for the Electrical Cable Making Industry announces that there will be no "cost-of-living" alteration in wages on the third pay-day in April.

Social Event

In these days when the rising generation thinks musically in terms of "jazz," it is pleasant to return to the music of pre-war days, and the three performances of "A Country Girl," given by the "Clesco" Light Operatic and Dramatic Club must have proved an agreeable revelation to those younger members of the audiences to whom music and syncopated rhythm are synonymous. This play contains many tuneful numbers and the success of its presentation depends largely upon good singing by the principals and a strong well-trained chorus. These qualities the Club possesses in abundance, and with Mr. Clifford Thatcher to provide the humour, the performances reached a very high level, due appreciation being accorded by delighted audiences.

E.D.A. April Programme

The programme of the British Electrical Development Association for April contains further notes on the Eda Electric Homes Campaign: Three Plug Points. The local advertisement for the month, prepared for the use of electricity suppliers, dealers and contractors, advocates the use of various appliances in home for saving time and trouble. The window display features bedroom and boudoir appliances and involves a careful survey of stock and selection of electrical appliances which add light, warmth and comfort to the modern bedroom. The arrangement is simple, and dealers possessing the cube

The E.D.A. April Window Display

fitments and the modernist figures can install the display at small cost. The literature for the month includes a series of publications dealing with spring cleaning, washing and ironing, while further attention is drawn to the Campaign book entitled "3 Plug Points." The posters also deal with spring cleaning and washing. Notes are contributed by the director on the Eda Home Wiring Specification.

Annual E.D.A. Luncheon at Manchester

The annual luncheon, followed by the meeting, of the North-Western Area of the British Electrical Development Association was held at the Midland Hotel, Manchester, on March 16th. Over 150 representatives of all branches of the industry in the area attended. Sir Philip Nash occupied the chair, and in proposing the toast of "E.D.A.," referred to the excellent work which was being done in the area, and emphasised the fact that there was still plenty of scope for advance. He quoted comparative figures for the United States and this country, showing that the Americans had developed electrically at least three times as much as this country. The response to the toast was made by Ald. Huntsman, President of the Association, in his usually happy vein, and this terminated the formal part of the gathering.

Important Contract for Marconi's

The important contract for radio-telephone communication between Egypt and Europe has been placed in the hands of MARCONI'S WIRELESS TELEGRAPH CO., LTD. The Egyptian Cabinet approved the granting of the concession on March 21st. An explanatory note stated that three offers were received: from Marconi's, the "International Telephone Co.," and a French concern. It was said that the Government was satisfied that Marconi's were best able to carry out the concession, as they guaranteed communication with England without delay, and the French concern could not do this. Rapid communication with England is most important, first because the links between Egypt and England are double those between Egypt and France; secondly, because it is essential for Egypt to be linked with North America, Australia, and other places with which London already has rapid communication; and thirdly, in view of the cotton conversations between Lancashire and Alexandria. Marconi's tender was also the lowest.—*Reuter* (Cairo).

B.I. to Make Oil-filled Cables

British Insulated Cables, Ltd., has taken out a licence under the Pirelli patents for the manufacture of oil-filled cables. Plant has already been installed at the Prescot factory, and is now in operation. The company states that it is in a position to supply the cables for voltages up to and including 132 kV.

Reyrolle at the B.A. Exhibition

MESSRS. A. REYROLLE & CO., LTD., have sent us a photograph of a cablegram received from Buenos Aires last week. This was in the following terms:—"H.R.H. Prince of Wales inaugurated British Empire trade fair by operating scale model of Reyrolle panel."

A Window Cinema Display

An original idea for compelling attention has been conceived by the introduction of an automatic daylight projector in one of the large windows of the West Ham Electricity Department's showrooms in Romford Road, Stratford, E. The window has been tastefully laid out; on one side is displayed a working demonstration model of a washing machine, and on the other a model of a lady, one half of the figure dressed in a dirty overall with face and hands smudged, and the other half showing a clean garment, &c. On the dirty side, the model is holding a broom and on the clean side an electric vacuum cleaner. The model is fixed to a moving turntable, and suitable showcards are displayed. The chief attraction is the moving picture in the centre showing the various domestic uses of electricity. The films are hired from the British Electrical Development Association, and the projector used is automatic and requires little attention. The film is shown continuously, repeating itself automatically when finished, but is adjusted to stop, if necessary, when the picture has shown. The picture is seen equally well during the day and at night.

Reports on Dominica and Hayti

A combined report by British consular offices on the economic conditions in the Dominican Republic and Hayti has been issued by the Department of Overseas Trade, through the Stationery Office (1s. 9d. net). There is little of electrical interest in the report, but it is noted that imports of electrical machinery into the Dominican Republic in 1929 had a value of $211,195, of which the United States was responsible for 71 per cent.

New Lamp Agreements

The Philips Company, of Eindhoven, Holland, announced last week that it had concluded long-term contracts with the General Electric Company, of New York, the Osram Company, of Berlin, and the Compagnie des Lampes, of Paris, providing for a mutual exchange of technical information relating to electric lamps.—*Reuter* (Amsterdam).

Trade Announcements

MR. F. LOMAX is moving to 162, Cross Lane, Salford, and asks for window-display material, manufacturers' catalogues, &c.

MESSRS. J. H. TUCKER & CO., LTD., Birmingham, inform us that Mr. L. R. Erlynne has joined them as outside representative for the West, North-West, and City (part) areas of London, operating from their London office. Mr. Erlynne was previously with the Electrical Equipment & Carbon Co., Ltd.

WATERTIGHT FITTINGS, LTD., Chesterfield, has appointed Messrs. P. L. Dwyer & Co., 30, Grosvenor Place, S.W.1, as London agents.

MESSRS. R. O'BRIEN & CO., 66, Mosley Street, Manchester, state that although their premises were recently badly damaged by fire the business is being carried on as usual.

MR. WALTER ELLIS, A.M.I.E.E., formerly manager to the Welwyn Garden City Electricity Supply Co., Ltd., is now trading as the Universal Manufacturing Co., electrical factors and agents, 7c, St. George's Circus, S.E.1. He asks for catalogues, &c.

A "Specials and Service Department"

This is the title given to a new works which the MIDLAND ELECTRIC MANUFACTURING CO., LTD., Birmingham, has recently built. As can be inferred from the name, the function of this works is to deal with inquiries for, and the production of, variations from the company's standard designs of switch- and fusegear, and to carry out work of a special nature for the company's customers. A booklet (No. 178) has been issued describing the scope of the new department.

Recent Contracts

The BRITISH THOMSON-HOUSTON CO., LTD., Rugby, has obtained repeat orders from the London Electric Railway Company for the following mercury-arc rectifiers: Seventeen of 1,500 kW each, and five of 2,000 kW each. These rectifiers, which are of British design and manufacture, will be installed in nine sub-stations, for which the complete B.T.-H. equipment will include, in addition to the rectifiers, over 100 air-blast transformers, 120 high-speed circuit-breakers and 60 heavy-duty oil circuit-breakers. In all cases the rectifiers will be provided with automatic control gear for remote operation. This is said to be the largest order for mercury-arc rectifiers placed in this country. The B.T.-H. Company also has in hand the manufacture of two 1,200-kW mercury-arc rectifiers for the Barking-Upminster electrification scheme of the L. M. & S. Railway, while a B.T.-H. rectifier will shortly go into service on the Manchester-Altrincham Railway, the electrification of which is nearing completion.

A tender submitted on behalf of the PATENT LIGHTING CO., LTD., of Hayes, Middlesex, for the floodlighting of the Rand airport, South Africa, has been accepted by a joint committee of the Germiston and Johannesburg municipalities. The amount is £10,416. The plant includes eight floodlight lanterns, beacons, landing signal, illuminated wind indicator, and electrical acoustic plant.

An order has been placed with STEATITE & PORCELAIN PRODUCTS, LTD., Stourport, for insulator strings for the Punjab Uhl River hydro-electric scheme. These are for use at railway crossings, where the insulators must be of exceptional strength and reliability. The contract was secured in the face of international competition. The main contractor for the work is Callender's Cable & Construction Co., Ltd.

The ALTON BATTERY CO., LTD., claims that the batteries which it is supplying for the Mayfair Exchange (mentioned here last week) will be the largest telephone batteries in the world. The company also mentions that the orders for batteries for Colombia and Venezuela were obtained in the face of keen American competition. Plans are in progress to increase the output from the Alton works by 50 per cent., which is encouraging in these days of industrial depression.

New Catalogues and Lists

The NATIONAL ACCUMULATOR CO., LTD., 93, Great Portland Street, W.1.—Four showcards, illustrating in colour the "Dagenite" series of accumulators for radio and car-starting and lighting.

The ZENITH ELECTRIC CO., LTD., Villiers Road, Willesden Green, N.W.2.—A comprehensive catalogue of "Zenith" adjustable tubular resistances; fully illustrated and priced.

CALLENDER'S CABLE & CONSTRUCTION CO., LTD., 2, Surrey Street, Strand, W.C.2.—Pamphlet No. 112 containing illustration and dimensions of the company's lead sleeve service tee boxes; and Pamphlet No. 114 illustrating and describing lead sleeve plumbing rings for cable joints.

W. J. FURSE & Co., LTD., Traffic Street, Nottingham.—Reprints of articles on the electrical equipment of cinema theatres, &c., by one of the company's engineers.

PHILIPS LAMPS, LTD. (X-Ray Department), 145, Charing Cross Road, W.C.2.—A leaflet bearing an illustration and particulars of the company's ballistic milliampère-seconds meter for use in radiography.

The MAGNA WIRE & CABLE CO., LTD., 136, Borough High Street, S.E.1.—Priced and illustrated pamphlets advertising "Hellux" couplings for raising and lowering street-lighting fittings. Also a leaflet dealing with "Hellux" table lamps.

FERRANTI, LTD., Hollinwood, Lancs.—A handsomely-produced catalogue of "Ferranti" fires, containing illustrations, details and prices of ten models and special "surrounds" for some of these.

G. & J. WEIR, LTD., Cathcart, Glasgow.—A pamphlet descriptive of the new "Pyro" fuel-oil pressure pump with incorporated electric drive.

The MARCONIPHONE CO., LTD., 210-212, Tottenham Court Road, W.1.—A window streamer and a window bill announcing reductions in the prices of the company's radio sets.

Flex Required for Montevideo

The Department of Overseas Trade reports the Administration of the State Electricity Works, Montevideo, is calling for tenders for the supply of 490,000 metres of rubber insulated flex for interior installation. Tenders will be received in Montevideo up to April 15th.

It is suggested that firms should take this matter up through their local agents, or communicate with Dr. Ricardo Vecino, 41, Avenue de l'Opera, Paris, who is in a position to supply photographic copies of the Cahier des Charges at a cost of 30 fr., and is also prepared to handle British tenders. The Department of Overseas Trade desires to be informed of any action taken regarding this call for tenders.

Prices of Materials

Messrs. F. Smith & Co. report, March 24th: Copper (electrolytic) bars, £48 10s., £2 2s. 6d. decrease; ditto ditto sheets, no change; ditto ditto wire rods £58 10s., £2 2s. 6d. decrease; ditto ditto h.c. wire, 7-9/16d., ¼d. decrease. Silicium bronze wire 9¼d., ¼d. decrease.

Messrs. Edward Till & Co. report, March 24th: India rubber, Para fine, no change.

Messrs. James & Shakespeare report, March 24th: Copper bars (best selected), sheet and rod, no change. English pig lead, £13 5s., £1 5s. decrease.

Electricity Supply

Lighting, Domestic, Power

Aylesbury.—LOANS.—The Town Council has applied for sanction to loans of £15,000 for mains and services and £6,000 for the assisted wiring scheme. The mains are to be extended to Cholesbury at an estimated cost of £1,115. Sanction has been received to a loan of £270 for mains and sub-station equipment for the supply to Moreton. The cost of the scheme will be over £5,000.

Bedford.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to borrow £10,000 for domestic electrical appliances.

Bedlington.—NEW SUB-STATION, &c.—The Newcastle-upon-Tyne Electric Supply Co., Ltd., is to erect a 20,000-V switch house and sub-station in the town. The Town Council has approved of the scheme.

Bexhill.—NEW METERS.—The Corporation Electricity Committee is seeking sanction to borrow £3,000 required for the purchase of meters for 12 months.

Buxted.—OVERHEAD LINES.—The Electric Supply Corporation, Ltd., has informed the Rural District Council of its intention to proceed forthwith with the erection of overhead lines for the supply of electricity to the parishes of Framfield and Buxted, where underground mains will be laid.

Canada.—NEW PLANT FOR BEAUHARNOIS COMPANY.—What is claimed to the largest vertical-shaft generator so far built in Europe is at present in course of construction at the works of the Oerlikon Co., in Switzerland. The machine, which is intended for the new hydro-electric power station which is being erected by the Beauharnois Co. on the St. Lawrence River, near Montreal, will have a capacity of 44,000 kVA at 75 r.p.m., the turbine working under a head of 82 ft. The stator of the generator will weigh 282 tons and the rotor 320 tons, the total weight, including the supporting bearings, being 625 tons.

ELECTRICAL DEVELOPMENT.—The Beauharnois Power Corporation has resumed active construction work on the power canal and is assured of a steady market for its output owing to the increasing demand of the Montreal district. The company has already contracted in advance for the delivery of 462,000 h.p. of the 500,000 h.p. to be produced when the work is complete The Alcoa Power Company is installing in its plant at Chute à-Caron, Quebec, four large waterwheels, supplied by the Canadian Westinghouse Company. These four generators have a combined capacity of 308,000 h.p.

According to a report of the Dominion Bureau of Statistics the output of power from central power stations in Canada during 1930 amounted to 18,256,000,000 kWh, including an estimate of 400,000,000 kWh for the small stations. The large stations generated approximately 98 per cent. of the total *i.e.*, 17,856,122,000 kWh, of which 17,553,763,000 kWh was generated by water power.

Continental.—GERMANY.—The industrial depression is still making itself felt in a reduced demand for electric power in Germany. During December last the output of the 122 principal electric supply undertakings in the country amounted to 1,423,400,000 kWh, bringing up the total for 1930 to only 16,214,300,000 kWh, as compared with 16,906,400,000 kWh in the preceding year, a decline of about 4 per cent.

NORWAY.—A new hydro-electric power station has recently been completed on the Glom Fiord in Northern Norway by the Norwegian Government. The plant so far installed comprises three 27,500 h.p. turbo-generators. The station, the capacity of which will eventually be increased to 133,000 h.p., is supplying power to the aluminium works at Haugwik, about 3 miles away from the plant.

Douglas (I.O.M.).—ASSISTED WIRING SCHEME.—In the estimates for 1931-32 provision is made for £1,500 to be spent on an assisted-wiring scheme. There are about 2,000 small dwellings in Douglas which are not electrically lighted. The wiring work will probably be let to local contractors.

Glasgow.—NEW MAINS.—The Corporation Electricity Committee has recommended that distributing mains be laid at a cost of £2,932.

ELECTRICAL PROGRESS DURING FEBRUARY.—Under the Corporation Electricity Department's scheme 739 houses were wired in February, making the total to date 30,063, while hired appliances numbered 29, making the total 21,084.

Kettering.—NEW ELECTRICITY CHARGES.—The Urban District Council has approved revised charges for electricity to come into effect after the June quarter next. The principal changes are in the domestic tariff, which will be 6½d. per kWh for a certain number of kWh according to the rateable value of premises and ¾d. per kWh for the remaining energy consumed in the summer months and 1d. per kWh in the winter months. The business premises tariff has been changed from a standing charge based on the net rateable value to a standing charge based on the wattage of lamps. Consumers on the "all-in" tariff will pay for electricity consumed and meter rental as in the case of other domestic consumers, plus a separate charge for wiring rental.

Liverpool.—ESTIMATES FOR 1931-32.—Mr. P. J. Robinson, city electrical engineer, states that the capital expenditure upon the electricity undertaking in 1931-32 is estimated at £998,200,

which includes work done and goods delivered but not paid for (£403,200), generating station and plant (£260,000), sub-station plant and buildings (£80,000) and mains (£255,000). Income is estimated at £1,510,000, while it is anticipated that the receipts of the Supply and Fittings Department will exceed the expenditure, and will also provide for the charges on capital account.

ELECTRICITY SUPPLY.—The City Council has decided to take over the electricity undertaking of the West Lancashire Rural District Council in respect of the parishes of Maghull, Aughton, and Lydiate, as from April 1st.

Lowestoft.—ELECTRICITY EXTENSION.—The Town Council has applied for a loan of £1,800 for supplying electricity to Oulton.

London.—STOKE NEWINGTON.—The Electricity Committee is seeking sanction to a loan of £2,000 in respect of new electric street lamps.

ST. MARYLEBONE.—The Borough Council Electricity Committee has recommended the expenditure of £45,867 in respect of an extension of cables, switchgear, and transformers, and the Finance Committee has recommended that application be made for sanction to a loan to cover the cost of the work.

ST. PANCRAS.—The Electricity and Public Lighting Committee has recommended the laying of new e.h.p. and l.p. cables in various parts of the borough, at a cost of £14,100, and the Finance Committee has recommended that application be made for sanction to a loan to carry out this work. The Borough Council has also been recommended to adopt a hire-purchase scheme.

HACKNEY.—The Electricity Committee proposes from April 1st next to offer a new two-part tariff to prepayment consumers who undertake to use electricity for cooking. The new tariff will be a weekly charge of 2½d. per point and a weekly rent for cooker, kettle, iron, &c., proportional to ordinary hire charges, the "unit" charge for all electricity consumed being ½d. per kWh.

Preston.—EXTENSION OF ELECTRICITY SUPPLY.—The request to the Corporation Electricity Committee to supply electricity to Garstang, Grimsargh, Longridge, and Ribchester, has been acceded to, and the Committee has qualified for a grant of 50 per cent. interest on a loan of £22,200, repayable in 15 years.

LOANS.—The Committee has applied for sanction to loans of £2,900, for the supply of electricity to Bilsborrow and Elswick; £5,000 for an overhead line extension to Hoole and Catforth, and to provide for future extensions, £2,970 for the supply of electricity to Broughton and Fulwood, and £20,000 estimated expenditure on cookers and domestic apparatus.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

NEWMILL.—Scale "A": Minimum charge from £1 6s. to £1, and "unit" charge from 6d. to 5½d. Scale "B": "Unit" charge 1½d. up to 50 kWh, and 1½d. per kWh beyond.

TRING.—Shops and combined business premises: From 1½d. to 1½d. per kWh. A limiter is to be fixed at an annual charge of 10s.

DERBY.—Electricity outside the borough: A reduction of ½d. per kWh.

Portland.—ASSISTED WIRING SCHEME, &C.—The Urban District Council Electricity Committee has decided to consider the reports of the Electricity Commissioners' committees upon assisted wiring and the hire of electrical apparatus, at its July meeting.

Northwich.—ELECTRICAL PROGRESS.—The Mid-Cheshire Electricity Supply Co., Ltd., which operates the Northwich and District Electric Lighting Order, and the Mid-Cheshire Electricity Special Order, has had a year of record progress, having added 600 new consumers, increasing the connections by 1,000 kW and the annual consumption by 660,000 kWh to 3,857,862 kWh. The cost of electricity in bulk and distribution charges amounted to £18,977 against which there was an income by the sale of electrical energy, meter, cable and transformer rents amounting to £47,135.

Snaith.—ELECTRICITY SCHEME.—As the result of a survey of the town, the Yorkshire Electric Power Co. has decided to commence laying cables for the supply of electricity.

South Downs.—OVERHEAD LINES.—According to the *Morning Post* an alteration has been made in the plans of the Central Electricity Board for the supply of electric current to Ringmer, Lewes, and Newhaven. Residents in this rural area had feared that the Board would run overhead cables across Mount Caburn and the surrounding hills to Southeram, just below it, and thence down the Ouse Valley to Newhaven. A report protesting against this proposal has been sent to the Brighton, Hove and District Joint Town Planning Advisory Committee. It is stated on behalf of the Central Electricity Board that although the cables as originally proposed might have passed over Mount Caburn and the surrounding hills, it could not be admitted that the results would have spoiled the beauty of the neighbourhood. In fact, the route by which the cables will be taken is not yet decided. Negotiations are proceeding on the subject of wayleaves, but the cables will neither cross Mount Caburn nor stand on the skyline at any point. They will run down the valley from Ripe to Beddingham, past Glynde, and thence will follow the valley of the Ouse to Newhaven.

Stourport.—OVERHEAD LINES SANCTIONED.—The Minister of Transport has granted permission to the Shropshire, Worcestershire & Staffordshire Electric Power Co. to place overhead lines across Hartlebury Common between Stourport and Worcester and Redditch.

Swansea.—SUPPLY TO DOCK BASIN.—The Corporation Electricity Committee has arranged to provide a supply of electricity at North Dock Basin for the G.W. Railway at a cost of £2,000, payable by the railway company.

Sunderland.—PLANT EXTENSIONS.—The Corporation has decided to carry out an extension of the switchhouse at the Hylton Road generating station at an estimated cost of £6,358, and also to make additions to switchgear, and carry out other incidental work at an estimated cost of £14,554.

LOAN.—Application is to be made for sanction to the borrowing of £15,000 for mains extensions, and £5,000 for the equipment of consumers' sub-stations.

Thanet.—SPECIAL ORDER.—The Isle of Thanet Electric Supply Co., Ltd., has applied for a Special Order to supply electricity in the Minster area.

Wallasey.—ELECTRICAL DEVELOPMENT.—An interesting review of the electricity undertaking was given at the last meeting of the Town Council when the chairman of the Finance Committee commented on the indiscriminate adoption of the hire-purchase plan for promoting the sale of small apparatus. Some consumers, he said, were tempted to acquire appliances of which they were not really in need because of the small quarterly payment, but the habit tended to grow until a material part of the weekly income was earmarked. Cases had been dealt with where consumers had ordered expensive and elaborate appliances on hire-purchase terms, yet the utmost difficulty had been experienced in collecting other moneys due to the Corporation. The accounts of the Department were satisfactory, all the estimates of revenue of 12 months ago having been exceeded. The revenue from the hire-purchase scheme brought in £2,430 more than was estimated, bulk supply to Birkenhead £9,738 more than was anticipated, contract supplies showed £1,700 more, prepayment meter supplies £5,534, and heating and cooking supplies £1,736. Of the surplus of £27,300, £6,500 will go to rate aid, £9,000 towards capital expenditure on meters and services, £1,500 to reserve fund, and £500 for new machine tools.

Traction Notes

Birmingham.—NEW CARS.—By a decision of the Tramways and Omnibus Committee 11 modern double-deck top-covered vehicles are to be substituted for railless cars of an old type on the Nechells route.

Bradford.—RAILLESS CARS.—The railless-car service between Idle and Five Lane Ends was formally inaugurated on March 20th.

The Tramways Committee has re-appointed the reorganisation sub-committee and has decided to add additional fast-running cars to the present service.

Continental.—SWITZERLAND.—The Lake of Constance-Toggenburg Railway Co., whose lines unite Romanshorn with the Ricken line (Swiss Federal Railways) and with the St. Gothard line *via* St. Gall, Herisau, and Wattwil, has decided to electrify its various lines. The new rolling stock, the contract for which has been placed with the Ateliers de Secheron of Geneva, will comprise six 1,800-h.p. four-axle locomotives and two 900-h.p. motor coaches.

FRANCE.—According to the *Electric Railway, Bus and Tram Journal*, the new Paris underground railway running under the Grand Boulevards is now finished, and the work of repairing the roads and restoring the boulevards to their normal condition will shortly be begun. It is expected to take about six weeks, and during that time traffic will have to be suspended at many places between the Rue Montmartre and the Place de la Republique. The new line will continue that from Auteuil, the present terminus of which is at the meeting place of the Boulevard des Italiens, Boulevard Haussmann, the Rue Drouot, and the Rue Richelieu, up to the Bois de Vincennes, and will give through communication right across Paris from west to east. It will be the longest underground line in Paris. This new line will be particularly useful for visitors to the Colonial Exhibition, and it is now certain that it will open to the public before the exhibition opens early in May. It should relieve traffic on the Grands Boulevards, which are now very much congested.

London.—TUBE STATION IMPROVEMENT.—According to the *Morning Post* it is the intention of the Underground authorities to reconstruct Russell Square station. There will eventually be a subway station with three entrances at different corners of the cross roads of Woburn Place, Russell Square and Bernard Street. The booking hall will be of the circular type below the roadway and will resemble in miniature that at Piccadilly Circus. Escalators will be constructed to the platforms, and despite the depth will be in one flight. The total cost of the station will be about £150,000, and it is anticipated that the traffic will be considerably increased at this station when the extensions of the system to Cockfosters and Northfields are completed.

Middlesbrough.—CURTAILMENT OF SERVICES.—Owing to the continued trade depression which is affecting the receipts of the tramway undertaking, the Tramway Committee has decided to curtail the services on certain routes.

Telegraph and Telephone

Egypt.—AUTOMATIC TELEPHONY.—As we announced at the time, the conversion of the Mansura area from manual to automatic service took place last year. The Strowger "step-by-step" exchange equipment was made and installed by the Automatic Telephone Manufacturing Co., Ltd., which also supplied the apparatus fitted on subscribers' premises. In Cairo the installation of auto-exchange equipment is proceeding, and it is hoped to open the main system, serving the city areas, in the autumn. The exchange equipment, of the "rotary" type, is being manufactured and installed by Standard Telephones and Cables, Ltd., and the instruments fitted on subscribers' premises by the A.T.M. Company. When the scheme is complete, operation in Cairo and its suburbs will be entirely automatic. The intervention of a manual operator will take place for trunk calls and inquiries. A project is also in hand for the conversion of the Alexandria area, says the *Manchester Guardian Commercial*. A new building is now in course of erection and new trunk exchanges are also being installed at Cairo and Alexandria which will embody apparatus for the amplification of speech on long-distance calls. An underground trunk cable has also been laid between Cairo, Tanta, and Alexandria; it is 209 km. in length and has been manufactured and laid by the Pirelli-General Cable Works, Ltd.

The towns of Port Said and Suez are also to be converted from manual to automatic. New buildings are now in course of erection to house the equipment, which, it is hoped, will be brought into service in 1933. In Egypt four languages are officially recognised; all the operators must have a good working knowledge of Arabic, English, French, and Italian, and thus the possibility of errors is increased owing to the similarity in sound of different numbers; automatic telephones, which know no language, are a real solution of this difficulty.

Finland.—SWEDISH TELEPHONE ACTIVITY.—It is stated that the Swedish Ericsson Company is endeavouring to participate in the telephone system of Finland and that it has already acquired the majority of the shares of the largest private company, namely, the Vasa Telephone Company. This action has evoked opposition and it is said that the Finnish Government has laid before the Parliament a proposal to form a company with a share capital of 500 million Finnish marks to take over the whole of the country's telephone system.

India.—RADIO-TELEPHONY.—For the first time in history Bombay was in telephone communication with London on March 18th. By the courtesy of the captain of the Leyland liner *Belgenland*, which was lying in Bombay Harbour, *Reuter's* general manager in that city was enabled to converse by wireless 'phone with his company's head office in London. The communication was made through the instrumentality of the Indian National Marine Radio Company. It was just after 11 o'clock in Bombay (5.30 p.m. in London) and speech came through perfectly clearly, but at times there was fading which seemed to be corrected almost immediately by increased reaction.

Irish Free State.—TELEPHONE FINANCE.—A Bill now before the Dail seeks to grant further money for the development of the telephone system; the amount to be made available is not to exceed £250,000. The Minister for Finance is to be authorised to borrow by means of terminable annuities extending over a period not exceeding twenty years to repay the Central Fund from which the money will be issued. Two similar bills have been passed by the Oireachtas. One in 1924 provided £500,000 capital, and another in 1927 provided a like amount.

Japan.—RADIO-TELEPHONY.—The first tests were made this week by the British Post Office of new apparatus prepared with the object of establishing a wireless telephone service between Great Britain and Japan. The transmitting apparatus has been set up at Rugby, and the station at Baldock, Herts., serves for reception.

The Telephone Service.—TRUNKS SPEED-UP.—Steps are being taken by the Post Office to modify the methods of operating long-distance calls so as to enable a large proportion of such calls to be completed while the calling subscriber remains at his telephone, and so to encourage the use of long-distance communication.

United States.—AIRWAY RADIO BEACONS.—The whole of the long transcontinental airway route from New York to San Francisco is now provided with a complete radio directional service. A radio beacon service such as this renders flying possible under very poor visibility conditions without any appreciable deviation from the course. This is the first route of such a length to be completely radio controlled, although radio-beacon service is provided on some of the shorter airways, such as the Boston-Atlanta-New York and the Los Angeles-San Francisco lines.—*Reuter's Trade Service* (New York).

LARGE P.B.X.—What is claimed to be one of the largest private telephone exchanges in the world has been put into operation for the National City Bank, of New York, and its affiliated concerns. It has 800 trunk lines, 8,000 extensions, 800 tie lines, and a capacity of 45 million calls annually.

Some 40 men worked 18 months to construct it and 200 workmen placed it in operation in the new building of the City Farmers' Trust Company. Not an incoming call was missed during the change-over.—*Reuter* (New York).

Radio

Argentina.—ADVERTISING REVENUE.—The population of 10 millions scattered over an area of a million square miles is served by 16 radio broadcasting stations, which use wavelengths between 222 and 448 m. They are operated by individual concerns and derive their revenue solely from advertising.

Canada.—LICENCES.—Apart from the points at issue relative to Dominion and provincial control of local radio broadcasting, which are to be argued in the Supreme Court on April 9th, a Bill now before the Quebec legislature seeks, amongst other things, says *World-Radio*, to add 25 cents per annum to listeners' expenses by making each purchase two licences, one from the Federal and the other from the provincial Government.

France.—LARGER STATIONS.—It is reported that the "Poste Parisien" transmitter will soon start operating on a power of 60 kW. As "Radio Paris" is also to operate on increased power (probably 80 kW) it is evident that France is anxious to keep up with other countries in the matter of transmitter power. Strassburg already has a powerful transmitter, Toulouse is to install new plant, and there is to be a new station at Le Havre.

Poland.—NEW STATION.—A Marconi 16-kilowatt (21 kilowatt C.C.I.R. rating) medium-wave transmitter has been completed at Lwow. It has begun transmission and is replacing the low-power Marconi broadcaster temporarily erected at Lwow. The new station is the second built under the reorganisation scheme of the Polish Broadcasting Company and is being received at great strength over the whole of Poland and the greater part of Europe. In the British Isles alone approximately 1,000 listeners have reported on its quality.

North Regional.—TESTS AND PLANT.—On Monday last the new high-power dual-wavelength transmitter at Slaithwaite commenced to radiate for reception tests by the general public. The wavelength is 479.2 meters (626 kc/s) and when the second transmitter, which will relay the national programme on 305.5 meters, is introduced it will be possible to withdraw some of the existing transmitters in that region, such as those now situated in Manchester, Leeds, and Bradford, but the Newcastle-on-Tyne station will be definitely retained in service, since it will be 100 miles distant and so just without the new one's range. The latter should not be expected to provide consistently satisfactory service beyond a radius of approximately eighty miles from Huddersfield, for outside that range fading and possibly other types of interference will be almost inevitable after nightfall. Later when the second wavelength is brought into operation it will be necessary to re-arrange the wavelengths of the undermentioned stations: Manchester will use 479.2 m., the Midland regional (5 GB) will use 399 m., and Glasgow 376 m. The new Moorside Edge plant is similar to that at Brookman's Park and it is being given the longer wavelengths on account of the hilly area to be served. The site is 1,100 ft. above sea level and is about five miles from Huddersfield on the Oldham-Huddersfield road. No Government restriction was placed on the height of masts, and the aerials are supported by three masts, each 500 ft. high. They form a right-angled triangle, the distance between adjacent masts being 600 ft. Each mast is of triangular section, of lattice steel construction, and is supported at seven points by triple steel stays secured to concrete anchors; the weight of each mast is 40 tons. To avoid unsymmetrical radiation caused by "mast shadow effect," each mast is insulated from earth at the base by seven sets of porcelain insulators; the electrical continuity of the stays has also been broken by dividing them into sections by porcelain insulators. Severe weather conditions are experienced and it has been found necesary to design the aerial system to withstand a wind velocity up to 100 miles an hour. The formation of ice on the conductors, with consequent mechanical overloading of the entire aerial system, has also been guarded against by providing means whereby the power station generators can be connected directly to the aerials and the conductors heated by passing through them a current of several hundred amperes; approximately 100 kW will be required to produce sufficient heat to complete this operation in about twenty minutes. Each transmitter's water-cooled valves require a total filament current of 1,300 amperes at 20 volts. The anode current to the main power amplifiers is 19 amperes at 12,000 volts; in addition, a 2,000-volt supply is required for the master oscillator and a 3,500-volt supply for the modulated amplifier. Three grid-negative voltages are required of 2,000, 500, and 250 respectively. These supplies are all obtained from d.c. generators, with the exception of the master-oscillator filament supply, which is obtained from a storage battery owing to the extreme constancy of voltage required.

The generating plant consists of four six-cylinder solid injection Diesel engines of 345 h.p. at 335 r.p.m., each coupled to a direct-current generator having an output of 1,050 amperes at 230 volts. A complete set of motor-generators is provided for each transmitter, one of each type being in reserve; thus there are 15 sets.

West Regional.—SITE CHOSEN.—It is reported that the B.B.C. has chosen a site for its west regional station, which will serve South-West England and South Wales, at Watchet in Somerset, overlooking the Bristol Channel, 18 miles north-west of Taunton and 16 miles north-west of Bridgwater.

Contract Information

When "Contracts Open" are advertised in our "Official Notice" pages the date of the "Electrical Review" containing the advertisement is given in parentheses below

Contracts Open

Acton.—March 30th. Town Council. Replating of existing 120-cell battery at the public baths. (See this issue.)

Birmingham.—April 4th. Tramways and Omnibus Committee. 800 tons grooved steel girder tramway rails with necessary fish plates. Specification and form of tender from A. C. Baker, general manager, Tramways & Omnibus Offices, The Council House.

Bristol.—April 9th. Electricity Department. Non-prepayment single-phase and 3-phase 50-cycle meters. (See this issue.)

Dover.—April 8th. Corporation. Supply and laying of h.p. cable. (March 20th.)

Egypt.—CAIRO.—Ministry of the Interior. April 18th. Ice-making plant and accessories. (A.X. 10785.)*
April 21st. 494-kVA lighting installation. (A.X. 10804.)*
April 25th. Electricity meters. (A.X. 10817.)*
April 30th. Installation of a h.p. underground network at Zagazig. (A.X. 10816.)*
May 2nd. 250-kVA lighting installation for Asswan. (A.X. 10802.)*
April 15th. Ministry of Public Works. Diesel-electric propelling machinery for Seru oil tanker. Copy of specification and conditions of tender can be obtained from the Office of the Director-General, Mechanical and Electrical Deparment, against payment of 250 mills.—*Reuter's Trade Service* (Cairo).

Erith.—April 10th. Electricity Department. H.p. and l.p. switchgear and other sub-station equipment. Supply, laying, &c., of h.p. and l.p. cables. (See this issue.)

Farnworth.—April 11th. Urban District Council. L.p. cables, and l.p. boxes and pillar. (See this issue.)

Gainsborough.—Electricity Department. Two induction regulators and one 400-kVA transformer. (See this issue.)

Glasgow.—April 3rd. Corporation. Materials, including electrical fittings and cable. Specification from Director of Housing, 20, Trongate; offers to Town Clerk.

Great Western Railway.—April 9th. Electric wires and cables, telegraph ironwork and electric lamps. (March 20th.)

Hamilton.—April 6th. Electricity Department. Transformers and e.h.p. metal-clad, compound or oil-filled switchgear. (March 13th.)

Leeds.—March 31st. Tramways Committee. Materials required during year ending March 31st, 1932, including electrical sundries and electrodes. Specification and form of tender from Mr. R. L. Horsfield, general manager, 1, Swinegate.

London.—CENTRAL ELECTRICITY BOARD.—April 27th. Metering equipment for certain stations in the area of the North-East England Electricity Scheme. (March 13th.)
April 17th. Site works, foundation works and buildings at Macclesfield and Hartshead (North-West England and North Wales Scheme). (March 20th.)
April 27th. 132,000-V outdoor switchgear for the South-West England and South Wales Scheme. (March 20th.)
COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.—April 1st. Boiler-house coal-handling plant in connection with the Barking power station extensions. (February 20th.)
May 13th. Piping equipment for Barking power station. (See this issue.)
LONDON AND HOME COUNTIES JOINT ELECTRICITY AUTHORITY.—Supply and erection of overhead 11-kV 3-phase transmission line, complete with transformers, &c. (March 20th.)
Meters and transformers. (See this issue.)

Manchester.—March 31st. Corporation Electricity Department. Manufacture, laying, &c., of 33,000-V cable. (March 13th.)
April 10th. Waterworks Committee. Electrically-driven air compressor, pipes, valves, &c. (complete tenders only). Specifications (deposit £2 2s.) from engineer, Waterworks Department, Town Hall.

New Zealand.—WELLINGTON.—May 27th. Post and Telegraph Department. Branch telephone equipment. (A.X. 10812.)*
May 4th. Telephone keys, resistance spools and transmitter buttons. (A.X. 10844.)
May 5th. Public Works Department. 66-kV and 33-kV outdoor switchgear for Lake Coleridge. (A.X. 10722.)*
June 2nd. Two outdoor type automatic induction voltage regulators. (A.X. 10845.)
May 19th. 2,250 e.h.p. suspension insulator strings, complete with fittings.

Nottingham.—April 24th. Corporation Passenger Transport Department. 25 double-deck trolley vehicles, and supply and erection of overhead equipment. (See this issue.)

Plymouth.—April 6th. Corporation. Reactors. (March 20th.)

Portsmouth.—Electricity Department. Six kiosks, two 500-kVA Scott-connected transformer groups, and twelve 50-kVA single-phase transformers. (See this issue.)

Salford.—April 9th. Electricity Department. Stores, including electrical apparatus and materials. (March 20th.)

South Africa.—QUEENSTOWN.—April 11th. Municipal Council. Turbo-alternators, spray-cooling plant, rotary feed pump, &c. (A.X. 10800.)*

West Hartlepool.—April 6th. Electricity Department. Cable for 12 months. (March 20th.)

Whitwood.—April 4th. Urban District Council. Distribution mains and service lines on the underground and/or overhead systems to 308 houses.

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* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed

Bexhill.—Electricity Committee. Recommended :—
Meters for six months (£1,613).—Edison Swan Electric Co., Ltd.
Prepayment meters (£40).—Chamberlain & Hookham, Ltd.
Two one-unit type feeder pillars (£80 each) and one two-unit type (£89).—W. T. Henley's Telegraph Works Co., Ltd.

Dundee.—Electricity Committee. Accepted :—
Coal-handling plant (£14,674).—Mitchell Conveyor Co., Ltd.

Glasgow.—Electricity Committee. Accepted :—
Plant and appliances required in connection with the standardisation of frequency.—47 new motors (£1,087).—Crompton Parkinson, Ltd.
Twenty-one new motors (£1,434).—Metropolitan-Vickers Electrical Co., Ltd.
Ten new motors (£194).—Veritys, Ltd.
Two new motors and spares for rotaries (£377).—Bruce, Peebles & Co., Ltd.
Spares for rotaries (£227).—British Thomson-Houston Co., Ltd.; (£121) General Electric Co., Ltd.
Eighteen motors, rewound (£86).—McNicol & Co., Ltd.
Electro-medical apparatus, reconditioned (£102).—Schall and Sons.
Education Committee. Accepted :—
Installation of electric clocks and automatic bell apparatus at St. Saviour's R.C. School.—H. Warden.

Government Contracts.—The following contracts were placed by the various Government Departments during February :—

ADMIRALTY (CONTRACT AND PURCHASE DEPARTMENT).
Motor alternators.—Haslam & Newton, Ltd.
Turbine blading, casing and rotor.—Vickers-Armstrongs, Ltd.
Electric cables.—Anchor Cable Co., Ltd.; British Insulated Cables, Ltd.; Craigpark Electric Cable Co., Ltd.; Edison Swan Cables, Ltd.; Enfield Cable Works, Ltd.; General Electric Co., Ltd.; Greengate and Irwell Rubber Co., Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India Rubber Works, Ltd.; India Rubber, Gutta Percha and Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Liverpool Electric Cable Co., Ltd.; Macintosh Cable Co., Ltd.; St. Helens Cable and Rubber Co., Ltd.; Siemens Bros. and Co., Ltd.
Spark coils for w/t.—Watson & Sons (Electro-Medical), Ltd.
Motor generators.—Rotax (Motor Accessories), Ltd.
Electric lamps.—General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.; British Thomson-Houston Co., Ltd.; Siemens Electric Lamps and Supplies, Ltd.
Portable electric drilling machines.—Consolidated Pneumatic Tool Co., Ltd.
W/t panels and transmitters.—H. W. Sullivan, Ltd.; Gambrell Bros.
Resistances and elements.—Engineering and Lighting Equipment Co., Ltd.
Electric tractors.—Greenwood & Batley, Ltd.
W/t valves.—General Electric Co., Ltd.; Edison Swan Electric Co., Ltd.; Mullard Radio Valve Co., Ltd.
W/t silica valves.—Mullard Radio Valve Co., Ltd.
Brass, copper, and phosphor bronze wire.—F. Smith & Co.; T. Bolton and Sons, Ltd.; Richard Johnson & Nephew, Ltd.; Whitecross Co., Ltd.

WAR OFFICE.
Generators.—G. Kent, Ltd.
Switchboards.—British Thomson-Houston Co., Ltd.
Electric wire.—E. & E. Kaye, Ltd.

CROWN AGENTS FOR THE COLONIES.
Cable.—General Cable Manufacturing Co., Ltd.; Macintosh Cable Co., Ltd.; Standard Telephones and Cables, Ltd.
Ceiling fans.—Crompton Parkinson, Ltd.
Electric cookers.—General Electric Co., Ltd.
Electric fans.—Veritys, Ltd.
Generating plant.—British Thomson-Houston Co., Ltd.
Static condensers.—British Insulated Cables, Ltd.
Switchboard.—Erskine, Heap & Co., Ltd.
Water heaters.—Bastian & Allen, Ltd.
Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.

H.M. STATIONERY OFFICE.
Electric motors.—Meech Electric Drives, Ltd.

GENERAL POST OFFICE.
Protective apparatus.—K. E. Beswick, Ltd.; Phœnix Telephone and Electric Works, Ltd.
Telephonic apparatus.—Automatic Telephone Manufacturing Co., Ltd.; Ericsson Telephones, Ltd.; General Electric Co., Ltd.; Phœnix Telephone and Electric Works, Ltd.; Plessey Co., Ltd.; Siemens Bros. & Co., Ltd.

Battery-charging sets.—Stuart Turner, Ltd.
Cable.—British Insulated Cables, Ltd.; Connolly's (Blackley), Ltd.; W. T. Glover & Co., Ltd.; Hackbridge Cable Co., Ltd.; Johnson and Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.
Telephone cords.—British Insulated Cables, Ltd.; L.P.S. Electrical Co., Ltd.; Reliance Electrical Wire Co.; Siemens Bros. & Co., Ltd.
Telephone lamps.—General Electric Co., Ltd.
Charging panels.—General Electric Co., Ltd.; Power Equipment Co., Ltd.
Rectifiers.—Westinghouse Brake and Saxby Signal Co., Ltd.
Lead sleeves.—British Insulated Cables, Ltd.; George Farmiloe and Sons, Ltd.
Solder.—British Insulated Cables, Ltd.; Du Pois Co., Ltd.; G. W. Neale, Ltd.
Bronze wire.—Richard Johnson & Nephew, Ltd.
Insulated bronze wire.—British Insulated Cables, Ltd.
Flameproof wire.—Concordia Electric Wire Co., Ltd.; Macintosh Cable Co., Ltd.; Reliance Electrical Wire Co.
Electrical equipment.—Sale (Cheshire) telephone exchange sub-station: Ferguson, Pailin, Ltd. G.P.O. (South) London sub-station: J. G Statter & Co.
Telephone exchange equipment.—Radcliffe (Manchester): Automatic Telephone Manufacturing Co., Ltd. Ashfield (Birmingham area): General Electric Co., Ltd. Seven Kings: Ericsson Telephones, Ltd. Sub-contractors: Lancashire Dynamo and Motor Co., Ltd., for motor-generator sets; Electric Construction Co., Ltd., for ringing machines; Tudor Accumulator Co., Ltd., for batteries. Bishopswearmouth, Boldon, and Sunderland (Sunderland multi-exchange area): Ericsson Telephones, Ltd. Sub-contractors for Sunderland: Electric Construction Co., Ltd., for motor-generator sets and ringing machines; Pritchett & Gold & E.P.S. Co., Ltd., for batteries. Woodgate (Birmingham area): Siemens Bros. & Co., Ltd. Brentwood (Essex): Siemens Bros. & Co., Ltd. Sub-contractors: English Electric Co., Ltd., for charging machines; Crompton Parkinson, Ltd., for ringing machines; Hart Accumulator Co., Ltd., for batteries. Main (Oldham—in the Manchester area): Siemens Bros. & Co., Ltd. Sub-contractors: English Electric Co., Ltd., for charging machines; Crompton Parkinson, Ltd., for ringing machines; Chloride Electrical Storage Co., Ltd., for batteries.
Telephonic repeater equipment (Birmingham).—General Electric Co., Ltd.

H.M. OFFICE OF WORKS.

Electric lighting fittings.—Osler & Faraday, Ltd.

Grimsby.—Electricity Committee. Recommended:—
Steam and water pipework in connection with plant extensions at Electricity Works (£4,277).—Aiton & Co.
Health Committee. Recommended:—
Electric lighting of tuberculosis wards at Scartho (£370).—A. Stephenson.

Lichfield.—City Council. Accepted:—
Materials for e.h.p. and l.p. lines in connection with the extension of the electricity supply to Alrewas and Fradley (£2,444).—Pirelli, Ltd.

London — ISLINGTON. — Cleansing Committee. Recommended:—
Electric vehicle batteries (£294).—D.P. Battery Co., Ltd.
HAMMERSMITH.—Electricity Committee. Recommended:—
Supply of stores for 12 months from April 1st. Insulating compound.—Dussek Bitumen Co., Ltd. Electrical goods.—Falk, Stadelmann & Co., Ltd. Cables.—Derby Cables, Ltd. House service and joint boxes.—Siemens Bros. & Co., Ltd. Lamp columns.—Revo Electric Co., Ltd.; A. C. Woodrow & Co. Meters.—Aron Electricity Meter, Ltd.; Metropolitan-Vickers Electrical Co., Ltd.; Chamberlain & Hookham, Ltd.
Two 100-kVA oil-cooled transformers (£124).—Hackbridge Electric Construction Co., Ltd.
Switchgear at generating station (£1,788).—Harland Engineering Co.
Switchgear at two sub-stations (£2,140).—J. G. Statter and Co.
Cable (£103).—Derby Cables, Ltd.
STEPNEY.—Electricity Supply Committee. Recommended:—
Cables for two years ending March 31st, 1933.—W. T. Henley's Telegraph Works Co., Ltd.

Oldham.—Electricity Committee. Accepted:—
Reactors.—Ferguson, Pailin, Ltd.

Seaham Harbour.—Electricity Committee. Accepted:—
Facia sign and accessories at new station.—General Electric Co., Ltd.

Southend-on-Sea.—Town Council. Accepted:—
Adaptation of consumers' apparatus at the Leas & Chalkwell Esplanade.—W. Jay (£593); City Electrical Co. (London) (£109).

Weymouth.—Town Council. Accepted:—
Supply and laying of cables, &c., for extending the supply to Osmington Mills (£1,771).—District Transmission Lines, Ltd.

Forthcoming Events

BIRMINGHAM ELECTRIC CLUB.—Friday, March 27th. Grand Hotel, Birmingham. 7 p.m. "An Outline of the Work and Organisation of the Post Office Engineering Dept." Mr. J. Coxon.

INSTITUTE OF FUEL (*East Midlands Section*).—Friday, March 27th. Technical College, Derby. 7 p.m. "The Power Consumption of Boiler House Auxiliaries." Mr. P. H. N. Ulander.

ELECTRICAL POWER ENGINEERS' ASSOCIATION (*Kent Section*).—Saturday, March 28th. Royal Star Hotel, Maidstone. 6 for 6.30 p.m. Annual dinner and dance. (*London Western Section*).—Saturday, March 28th. St. Ermin's Hotel, S.W. 6.45 for 7 p.m. Annual dinner.

INSTITUTION OF ENGINEERS-IN-CHARGE.—Friday, March 27th. Holborn Restaurant, W.C. 6 for 6.30 p.m. Annual dinner.

INSTITUTION OF ELECTRICAL ENGINEERS.—Monday, March 30th. Institution, London. 7 p.m. Discussion on "The Rupturing Capacity of e.h.p. and l.p. Switchgear to be installed on Consumers' Premises." Opened by Mr. H. Astbury. (*North-East Students' Section*).—Friday, March 27th. Armstrong College, Newcastle-upon-Tyne. 7.15 p.m. Annual general meeting. "Electricity on the Aeroplane and Airship." Mr. F. L. Turnbull. (*South Midland Students' Section*).—Friday, March 27th. Joint meeting with the I.M.E. and I.C.E. Students' Sections. (*London Students' Section*).—Friday, March 27th. Florence Restaurant, Rupert Street, W. 7.15 for 7.30 p.m. Annual dinner. Saturday, March 28th. 2.30 p.m. Visit to North Metropolitan Electric Power Supply Co.'s power station at Willesden. (*North-Western Students' Section*).—Tuesday, March 31st. Engineers' Club, Manchester. 7.15 p.m. "Photo-electric Cells." Mr. C. H. Rennols. (*Wireless Section*).—Wednesday, April 1st. Institution, London. 6 p.m. "Short Distance Observations on Long-Wave Phenomena," and "Field Strength Measurements on Daventry 5XX." Mr. R. Naismith.

Our Service Department

INQUIRIES must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following:—

A delicate instrument of the galvanometer type for detecting magnetically the presence of shrapnel embedded in flesh.
"MIDDLETON" electric fire.
"COLUMBUS" electric fire.

Notes

American Rural Electrification

Notwithstanding a general state of depression, rural electrification proceeded in the U.S.A. during 1930 at what may be considered to be a practically uninterrupted rate, according to a survey recently completed by the Statistical Research Department of the National Electric Light Association. During the year 90,800 additional farms were added to the number already using electrical service, representing a gain of 16.3 per cent., which compares with an increase of 95,900 farms in 1929 over the year before.

A previous survey by the Association's Rural Electric Service Committee showed that at the end of 1923 some 166,140 farms were obtaining service. During the seven years since that time the number of electrified farms has increased more than three times and Table I below gives an approximate estimate covering the growth of the service in that period.

TABLE I.—GROWTH OF RURAL ELECTRIFICATION.

Dec. 31st of Year	Electrified Farms	Dec. 31st of Year	Electrified Farms
1923 ...	166,140	1927 ...	377,000
1924 ...	203,000	1928 ...	460,969
1925 ...	250,000	1929 ...	556,871
1926 ...	307,000	1930 ...	647,677

The number of electrified farms in the various geographic areas, and their increase during the year, are given in Table II.

TABLE II.—ESTIMATED FARMS ADDED DURING 1930.

Geographic Divisions	Number of Farms Served on Dec. 31, 1930	on Dec. 31, 1929	Farms Added	% Increase
New England ...	44,713	41,489	3,224	7.8
Middle Atlantic ...	111,795	95,921	15,874	16.5
East North Central	150,960	125,352	25,608	20.4
West North Central	64,647	54,419	10,228	18.8
South Atlantic ...	48,296	41,816	6,480	15.5
East South Central	26,304	18,829	7,475	39.7
West South Central	18,117	14,373	3,744	26.0
Mountain	43,916	40,367	3,549	8.8
Pacific	138,929	124,305	14,624	11.8
Total United States	647,677	556,871	90,806	16.3

B.S.S. for Steel and Gas Cylinders

The Association has issued specifications for "low carbon" steel cylinders for the storage and transport of "permanent" gases and for steel cylinders for the storage and transport of "liquefiable" gases. These specifications are based on the summary of recommendations for the storage and transport of "liquefiable" and "permanent" gases included in the first and fourth reports of the Gas Cylinders Research Committee of the Department of Scientific and Industrial Research.

The British Engineering Standards Association has just issued a specification for valve fittings for compressed gas cylinders. Particulars are given in an appendix of inspection gauges for checking the threads on the valves and the threads in the cylinder necks.

A further specification provides for identification colours for gas cylinders for gases most commonly in use, the underlying principle of the scheme being that yellow should represent toxic or poisonous gases, and red or maroon, inflammable gases.

Copies of these specifications, Nos. 341 and 349-1931, can be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 2s. 2d. each, post free.

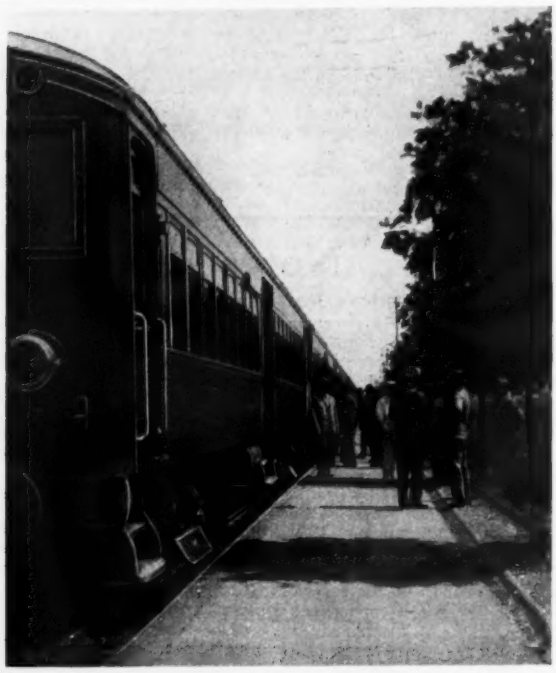
The Electrical Association for Women

The sixth annual dinner of the North East Coast branch was held at Newcastle on March 16th, when Mr. A. C. Cramb, director, British Electrical Development Association, was present. Mr. Cramb suggested the slogan "Homes fit for women to live in" as representing an ideal which electricity and electricity only could bring to reality. The E.A.W. might find a worthy purpose, he thought, in persuading women to use more electricity and also in training salewomen and demonstrators of electrical appliances. Miss Norah Balls, branch chairman, refuted the often held view that the E.A.W. was a society only for technical women.

A new branch of the Association was formed at Hull on March 16th, when Mrs. J. N. Waite, wife of the city electrical engineer, occupied the chair. A provisional council was formed, including Mrs. Morton Stewart as hon. secretary, Mrs. Waite and Councillor Mrs. Alderson (vice-president).

C.A.R. Electric Train

The photograph reproduced here shows the arrival of the first electric train at Borges, on December 18th, 1930, on a



portion of the recently converted Central Argentine Railway, some further details of which will be found on page 547 of this issue.

Electricity Supply in Bundaberg, Australia

The fuel consumption figures for the 330-h.p. oil-engine plant installed at Bundaberg, which were referred to on p. 476 of the ELECTRICAL REVIEW for March 13th, relate to b.h.p. hours.

Institution of Engineers-in-Charge.

The 31st annual dinner of the Institution of Engineers-in-Charge is being held this evening at the Holborn Restaurant.

Salt Deposit on Insulators

The Swedish inspector of railway electrical working in the second district, in reporting on the year 1930, states that an interruption of traffic extending over four hours took place at Gothenborg last autumn as a result of a "peculiar" circumstance. It appears that a moist sea wind of long duration resulted in the line insulators as far as Lerum receiving a deposit of salt which rendered them conductive and unserviceable. As a consequence the traffic had to be carried on by means of steam locomotives for the time being. Since then an estimate has been approved for the fitting of insulators of a new type which are not expected to be so liable to the salt danger.

Infinitely Variable Gearing.

Miss N. M. Jeans, lecturing to the Women's Engineering Society at the Lyceum Club, London, W., on March 18th, gave an interesting account of her researches in connection with an infinitely variable speed changing mechanism working on the hydraulic principle with two moving parts not mechanically connected. The efficiency of the gearing is expected to be of the order of 98 per cent. Full details are not available at the present stage of development, but Miss Jeans expressed confidence in a successful outcome of the investigations. The complete abolition of the present system of power transmission on even cheap motor cars was envisaged, but, if the anticipations of the lecturer are realised there should also be scope for such mechanism in starting against load and in obtaining rapid reversals of direction with the use of constant-speed electric motors.

Manchester Steam Users' Association

The annual report for 1930 shows that the Association's revenue reached £37,940, its members numbered 1,502, works 4,370, boilers 11,160, and the total number of examinations made during the year was 22,283. During the year the stripping of steam boilers for periodical examination was under consideration by Government Departments, and a conference of inspecting authorities with H.M. inspector of factories and the chief engineer of the Board of Trade was held at the Home Office. The Association's point of view was clearly stated, that it appears to be extremely desirable to retain the individual responsibility of those concerned for the safety of a boiler rather than to change the responsibility to that of complying with regulations, towards which the proposals would tend. Apparently the Association was the only inspecting authority directly representing boiler owners in a conference of over thirty persons. The Government proposal that unhoused boilers should be bared of brickwork every six years and housed boilers every ten years is not favoured, since stripping should be decided on individual consideration by the best inspection authorities; it does not favour indiscriminate stripping without regard to the conditions of the case.

A Consumer's Rights.

One of the French law courts has recently given a decision that an electricity supply undertaking must not cut off supplies to a consumer on the ground that the latter has not paid money owing by him. It appears that a consumer in Eastern France complained of the irregularity of the supply, and as a result refused to pay the account rendered to him; the supply company therefore disconnected his supply. The consumer thereupon brought an action for damages against the company and was awarded a sum of 500 francs. In giving a verdict for the consumer, the judge held (1) that consumers of electricity had the right to refuse to pay for irregular supplies, and (2) that in the absence of a special agreement no one had the right to take the law into his own hands. The company took the case to the French Appeal Court, which, however, upheld the original verdict in favour of the consumer.

The Possibilities of Liquid Helium

The nearest approach to perpetual motion was claimed in a recent public demonstration in Canada by Mr. J. P. Allen and Mr. J. L. Wilhelm, of the Physics Department of Toronto University. The demonstrators produced a 200-ampere current "without loss of energy" by means of a lead ring suspended in a tube of liquid helium, says *Reuter's* agency. The current "was kept going all the evening and no energy was expended," according to Prof. G. C. McLennan, head of the University Physics Department, who added that while laboratory experiments had been made previously that was the first time that liquid helium had been carried so far from the laboratory.

A Loud-speaker for Resistance Measurements

In the correspondence columns of *Nature* a reference is made to the improved results obtained by the use of a loud-speaker instead of a telephone in conductivity measurements. The system consists simply of a two-stage amplifier, with a factor of amplification of about 500, connected to a Kohlrausch bridge for measuring electrolytic conductivity, instead of the usual telephone, which is replaced by a loud-speaker. If, instead of a buzzer, a shielded oscillator is used, and if all the leads are lead covered and properly earthed, the apparatus can be adjusted to give a musical note of variable intensity which permits the determination of the minimum sound much more easily and agreeably, and even a little more accurately than with the telephone.

Educational

The Board of Education has issued Form 105U (Ti) containing particulars of the short courses for technical teachers which are to be held in Oxford, Birmingham, and London, the subjects including electrical engineering, telephony, telegraphy and wireless. Application must be made on Form 106U (Ti) before April 1st and claims for travelling expenses on Form 112U. Fees will not be charged to teachers admitted from schools in England and Wales.

Electrically-heated Soil

Experiments with a 1/10th-acre electrically-heated cucumber plot near Los Angeles are described in the *Electrical World*. These proved so satisfactory that a large field has been opened for electric heat as a forcing agent. Two similar plots were used in the experiment, one maintained at 70 deg. by wires placed beneath the soil and the other as a check plot. Forty-one days were required from planting to maturity on the heated plot, which was twenty days before cucumbers on the unheated plot were of marketable size. Moreover, the yield from the heated plot was double that of the other and brought $300, as against $150, and the crop was what is called "choice."

The installation cost was about $100 and the bill for current $40, so that the experiment more than paid for itself in one season. Iron, aluminium, copper, and nichrome bare wire all proved unsuccessful due to rapid oxidation. No. 14 weather-proof wire was found most suitable. It is expected this will last two seasons. Upon the gardener's recommendation a temperature of 70 deg. was thermostatically maintained. This is probably higher than necessary and also it appears that the last two weeks of heating could have been eliminated.

Home-grown Larch Poles.

The Department of Scientific and Industrial Research has issued a report, "The Use of Home-grown Larch Poles for Transmission Lines," published by H.M. Stationery Office as Forest Products Research Bulletin No. 8, price 2s. net, indicating how home-grown larch poles can be treated so as to render them suitable for use for telegraph, telephone and power transmission lines. Hitherto larch has not been considered satisfactory for this purpose, and indeed has not been included up to now in the specifications for timber to be used in connection with the Electricity Commissioners' electrification schemes. The chief objection to the use of larch for transmission lines is based on the behaviour of creosoted poles used during the war. The creosote did not penetrate the larch to any great depth when subjected to the methods of treatment then in use, and after erection the poles were liable to crack or split severely, the resulting openings in the surface being broad and deep and extending practically the whole length of the pole. Experiments carried out at the Forest Products Research Laboratory with two consignments of 50 larch poles from Tintern Forest, Monmouthshire, have shown that with suitable treatment the above difficulties can be overcome. It has been found that if the larch poles are peeled and a number of incisions made in them with a broad knife, satisfactory penetration for the preservative can be obtained. It has also been found that the incisions have a distinct influence on the nature of the cracking which occurs during drying. The wide deep cracks typical of unincised larch are replaced by a great number of narrower, less deep openings, and there is less tendency for the drying crack in the incised poles to break through the protective band of preservative to the unprotected timber within. The incisions made in the poles appear to have a slight weakening effect on their strength, but even in the case of incised poles it has been shown that home-grown larch poles are 25 to 30 per cent. stronger than imported poles of Scots pine of the same dimensions. The report suggests that the most satisfactory creosote treatment for larch poles is the Bethel full-cell process carried out when the timber is seasoned to a moisture content of about 25 per cent.

Orleans Railway Electrification

The Orleans Railway Company has decided to electrify the section of its Paris-Nantes line from Les Aubrais, near Orleans, to Tours, a distance of about 75 miles. The programme, which the *Railway Gazette* states, is to be completed in 1933, falls into three chief parts:—(*a*) Erection of a power distribution line at 90,000 volts from Chaingy (Loiret) to St. Pierre-des-Corps, near Tours. (*b*) Construction of traction sub-stations at 90,000/1,500 volts. (*c*) Erection of subsidiary traction lines at 1,500 volts. It will also be necessary to raise several bridges.

Five sub-stations will receive power from the 90,000-volt line, which is to be constructed between Chaingy and St. Pierre-des-Corps. Power will be taken at the 220,000/90,000-volt station at Chaingy, which is situated on the high-voltage line between Paris and the Central Plateau. The line now being completed between Chaingy and Paris will convey power from the steam power station at Gennevilliers and the hydro-electric station at Eguzon and Coindre (Haute-Dordogne). It is already connected to the Lyons district and the Alps by a 90,000-volt line terminating at Theillay.

The electrification of the Orleans system, which has already been carried out between Paris and Vierzon, was to have been continued at first in the direction of Chateauroux and Brive, where work had already been carried out in the raising of bridges and the removal of telephone wires. The company, however, has decided that it was preferable to electrify the Orleans-Tours section first, as this scheme allowed a better use to be made of its locomotives. In consequence, the electrification of the Vierzon-Brive section has been postponed.

An important result of the electrification now to be carried out will be an improvement in the company's time-tables. The two great expresses to the Spanish frontier, the Sud-Express and the Pyrenees-Côte-d'Argent, will no longer stop at Les Aubrais to change engines, as they have done hitherto. There will also be notable improvements in the times of the ordinary trains between Orleans and Tours, a section on which at present the slower trains make numerous stops.

A Charitable Effort

The G.E.C. Dramatic Society is presenting Noel Coward's play "The Young Idea" at the Guildhall School of Music Theatre on March 30th and 31st. The proceeds are to go to the Infant's Hospital, Westminster. Tickets, ranging in price from 1s. 2d. to 10s. 6d., can be obtained from Miss N. Symonds, Secretary's Department, General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

International Illumination Congress, 1931

The arrangements for this Congress (which is being held in Great Britain from September 1st to 19th) are now well advanced. Members will spend two and a half days in London, where a very wide range of visits of technical and general interest and a noteworthy display of lighting have been arranged by the London Committee. The Congress will then proceed to Glasgow, Edinburgh, Sheffield, and Birmingham; one day in each city is to be devoted to papers and discussions on illumination; visits of varied interest have been organised, and members will be invited to attend a reception by the civic authorities in each of those cities. The last week of the Congress will be at Cambridge, where the plenary sessions and technical meetings of the International Commission on Illumination will take place. The Congress will be open to all interested in illumination in any of its branches, a registration fee of £2 being payable (ladies being registered free); the fee will include a copy of the proceedings of the Congress. Where a country has a National Illumination Committee it is desirable that registration should be effected through that committee, but registration can always be made through the central office. Every endeavour is being made to ensure that the cost of travel and accommodation shall be as reasonable as possible, and members from abroad can be assured of a most cordial welcome in this country.

Station Rating and Salaries

The *Ministry of Labour Gazette* records an Industrial Court decision in a matter put before it by the National Joint Board of Employers and Members of Staff (Electricity Supply Industry). The point was the different constructions placed by the two side of the Board upon the works "normal rated output of the electrical generators" in relation to the capacity of the stations at Yoker and Clydesmill. The Court took the view that as between a rating representing the maximum capacity of a generator, *i.e.*, the "continuous maximum rating," and a rating representing its maximum efficiency in relation to output, *i.e.*, the "service or economic rating," the words "normal rated output of the electrical generators" in the agreement of April 28th, 1923, referred to the "service or economic rating," namely, the rating representing maximum efficiency and not maximum capacity. The Court decided that in relation to the capacity of the stations at Yoker and Clydesmill as at July 1st, 1928, the generators installed should be assessed accordingly.

A Tramcar Travelling Showroom

A striking and apparently successful effort to popularise the use of domestic electrical appliances is that recently made by the El Paso Electric Co., of El Paso, Texas, which has had in operation for sometime a tramcar specially adapted as a travelling demonstration showroom. The seats at one end of an ordinary tram were replaced by an electric cooker, a "Kelvinator," a water heater, and a number of smaller appliances.

Electric Drive—Electric Service

The car was painted white inside and out, and was used in connection with an intensive sales campaign. Known as the Electric Range Special, the vehicle was operated four hours daily—over various sections of the company's electric tramway system. The car carried regular passengers, who paid the customary fare and could, if they so desired, enjoy a meal. Announcements in the newspapers gave the schedule and routes from day to day. A motor-generator installed under the car supplied the necessary current for the demonstration of the cooker and refrigerator. Side panel signs and sash board slogans advertised the many advantages of electric cooking and stressed the economy of complete electric service in the home.

A New Method of Insulating Wire.

A new method of insulating wire which, it is claimed, will prove much more economical than the present method has been developed in the United States. It consists of the application of a new material, called solventless varnish, which completely fills the pores of the fibrous material between the wires and becomes a solid integral part of the electrical apparatus. The application is similar to that employed at present and does not require any additional equipment. As a matter of fact, several parts and operations are eliminated. The varnish is placed in a container, the temperature is raised slightly to make it flow more easily, the object to be insulated is placed within a second container, and the lid clamped down. The air inside is removed to form a high vacuum, pressure is applied, after which the varnish is drawn from the first container into the second until the object is completely submerged, and several hours are allowed to elapse to permit the varnish to penetrate into the innermost recesses; a special drain removes the excess. The impregnating materials used at present are approximately half solvent when applied; consequently when evaporation takes place air holes remain. It is claimed that tests show that the new process will probaby increase the life of insulation about 25 per cent.

Our Personal Column

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements

Sir James Devonshire retired from the chairmanship of the Cambridge Electric Supply Co., Ltd., last year. He is succeeded by **Mr. A. N. Rye,** the managing director. The latter's position has been filled by the appointment of **Mr. A. Anderson.**

Major H. C. Parker, manager of the Walthamstow insulation and moulding works of Thomas De La Rue & Co., Ltd., has been appointed a director of the company.

Mr. F. Young, formerly with the Kent Power Co., Ltd., and for the past three years installation engineer with the Tonbridge Urban Council, has commenced business with Mr. A. T. Langton as an electrical contractor.

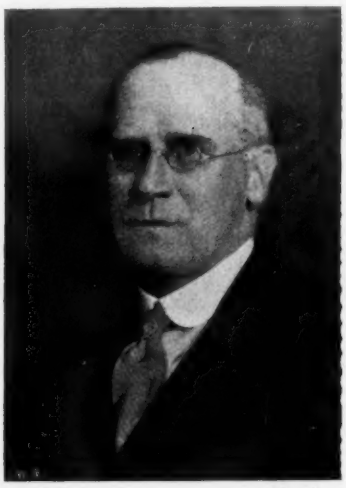
Mr. L. F. Smith, electrical engineer, who laid the cables for the supply of electricity to Clitheroe, was presented with a cheque and silver plaque at the March meeting of the Clitheroe Town Council in recognition of his services to the Electricity Department.

Mr. G. R. Laithwaite, of Hindley, who had been in the service of the Wigan Coal Corporation, has been appointed mains superintendent to the Worksop (Notts.) U.D.C.

Mr. L. R. D. Helm, Stoke-on-Trent, **Mr. D. M. Thornton,** Edinburgh, and **Mr. N. M. Wallace,** Gretna, have been appointed district engineers in connection with the Dumfries County Council's electricity scheme, at salaries of £300 per annum each.

The Rawtenstall Town Council has confirmed the appointment of **Mr. F. Lythgoe,** general manager of the Leigh Corporation motors, as manager of the tramway and omnibus undertaking at a commencing salary of £500 per annum, rising to £550.

At the last Council meeting of the B.E.A.M.A. (Mr. J. A. Hirst, deputy chairman, presiding) it was resolved on the motion of Dr. Railing, seconded by Sir Philip Nash, that **Mr. Victor Watlington** be re-elected Chairman of the Council.



Swaine] [*London*

Mr. H. C. Siddeley

In charge of the B.E.A.M.A. exhibit at Buenos Aires

Mr. Watlington, as our readers are aware, is at present at Buenos Aires in connection with the Association's important work at the British Empire Trade Exhibition there.

We reproduce herewith, as a matter of topical interest, a portrait of **Mr. H. C. Siddeley,** who is in charge of the B.E.A.M.A. exhibit at Buenos Aires. Mr. Siddeley, after serving in the electrical department of the L. & N.W. Railway, became London manager for the Lancashire Dynamo and Motor Co., Ltd. He subsequently formed H. C. Siddeley & Co., Ltd., of which he is still managing director. He has been connected with British electrical companies in Australia and China. As he has also travelled extensively in all parts of the world he can fairly claim to have a wide experience of export markets and should do good work for the electrical industry at Buenos Aires.

Mr. P. V. Hunter, chairman of the executive of the National Register of Electrical Installation Contractors, recently visited Scotland and addressed meetings in Glasgow and Edinburgh upon the aims and objects of the National Register.

At the eighth annual commemoration dinner of the Whitworth Society on Monday last **Sir Henry Fowler,** K.B.E. (president), who was in the chair, announced that **Prof. F. C. Lea,** O.B.E., of Sheffield University, had accepted nomination as president-elect, to take office in July next, and that the summer meeting of the Society would be held in Sheffield. Great regret was expressed at the enforced absence of **Dr. H. S. Hele-Shaw** as the result of his recent serious motor-car accident and it was hoped that he would speedily recover.

A portrait of **Mr. J. C. Denison-Pender,** governor and managing director of Cables & Wireless, Ltd., was unveiled by Mrs. Denison-Pender at Electra House, Moorgate, E.C., on Tuesday last.

Mr. Charles Seaforth Wallbridge, A.M.I.E.E., of East Didsbury, Manchester, has written a technical novel "Through a Glass Darkly," which is being published by Messrs. Arthur H. Stockwell, Ltd., at 7s. 6d. net.

Mr. Herbert Morrison, Minister of Transport, has been invited by the Prime Minister to become a member of the Cabinet.

Mr. N. Pryce-Jones has resigned his position as engineer and manager of the Holywood (Co. Down) municipal electricity undertaking upon obtaining an appointment with the Central Electricity Board in London.

Mr. Lewis Hart, chief assistant, Publicity Department, Agricultural and General Engineers, Ltd., is being transferred to Blackstone & Co., Ltd., Stamford, as publicity manager.

We are sure that large numbers of our readers will desire to associate themselves with us in congratulating **Sir George Sutton,** Bart., upon the anniversary which he celebrates to-day, March 27th. He completes fifty years' service with W. T. Henley's Telegraph Works Co., Ltd., of which he is chairman. He commenced his connection with the company as its secretary on March 28th, 1881, about thirteen months after its incorporation. He became manager in the year 1886, and was elected to a seat on the board and appointed managing director in 1893. We well remember a meeting of shareholders held at the old offices in Blomfield Street in March, 1910, at which Sir George was presented with his portrait painted by Sir Luke Fildes, R.A. The responsibility of chairmanship of the company, in the building up of whose business he had played so striking a part, fell to his lot in 1918, and four years later (1922), His Majesty the King conferred the honour of baronetcy upon him. The position of pre-eminence that Sir George occupies in the electrical industry, and the world-wide fame of his company, make his fiftieth anniversary an occasion of peculiar interest and significance. We hope that he will live many years to watch the further progress of his own undertaking, and that of the industry as a whole.

Sir George Sutton, Bt.

Obituary

Sir George Fisher-Smith.—We regret to record the death, on Thursday last week, of Sir George H. Fisher-Smith, the chairman of the London Electric Wire Co. and Smiths, Ltd., and principal of Frederick Smith & Co., Halifax. Sir George, who was 84 years of age, was for many years prominent in Halifax affairs. He served on the Town Council for 21 years and was mayor for two years; he received his knighthood in 1913. He is survived by three sons and five daughters. The funeral took place at Warley Cemetery, Halifax, on Saturday last.

Mr. W. Woods.—On returning from the works to his home at Chester on March 20th, Mr. William Woods, cashier and chief clerk at the Helsby works of British Insulated Cables, Ltd., collapsed and died. For over 15 years Mr. Woods had been a member of the Hoole Council and for two years he had been chairman.

Mr. W. H. Brown.—The death occurred on March 17th, at Acton, of Mr. William H. Brown, who retired from the position of secretary to the Metropolitan Railway Company in 1924, after 52 years' service with the company.

Mr. W. Holt.—Another Metropolitan Railway official passed away last week. Mr. William Holt, who had been traffic manager of the railway for over 20 years, died at Ealing on March 20th.

Will.—The late **Mr. Emile Garcke,** president of the British Electrical Federation, and chairman or director of a number of electrical and traction companies, left unsettled property valued for probate at £166,411 gross (£152,534 net personalty).

Financial Section

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares

New Companies Registered

Eastern Distributors, Ltd.—Private company. Registered March 18th. Capital, £500 in 1s. shares. Objects: To carry on the business of dealers in and factors of apparatus and supplies of all kinds connected with wireless telgraphy, television and telephony, dealers in electrical apparatus, &c. The subscribers (each with one share) are: E. C. Cooper, "Salcombe," Fitzwalter Road, Colchester, incorporated accountant; J. S. Bush, St. Margarets, Lancaster Gardens East, Clacton-on-Sea, radio salesman. Acting secretary: E. C. Cooper. Solicitors: Page & Ward, Colchester.

S. Grey & Co., Ltd.—Private company. Registered March 14th. Capital, £5,000 in £1 shares. Objects: To acquire the business of a radio dealer, carried on by Sydney Grey at 745, Barking Road, Plaistow, E.13, as S. Grey & Co., and to carry on the same and the business of gramophone manufacturers, dealers in electrical fittings and goods, &c. The subscribers (each with one share) are: S. Grey, radio dealer, and Mrs. W. M. Grey, 745, Barking Road, Plaistow, E.13. Registered office: 745, Barking Road, Plaistow, E.13. S. Grey is the first director and chairman.

L. Kremner, Ltd.—Private company. Registered March 17th. Capital, £10,000 in £1 shares. Objects: To carry on the business of radio and electrical engineers, electricians, general contractors, manufacturers of and dealers in wireless transmitting and receiving apparatus and sets, electric accumulators and batteries, &c. The directors are: L. Kremner, "Ashdown," Middleton Road, Crumpsall, near Manchester, radio merchant, and S. Kremner, "The Quest," Okeover Road, Broughton Park, Salford, radio merchant. Secretary: S. Kremner. Registered office: 78, King Street, Manchester.

Olympia Radio, Ltd.—Private company. Registered March 17th. Capital, £10,000 in £1 shares. Objects: To carry on the business of radio and electrical engineers, electricians, &c. The directors are: I. Kremner, 10, Bignor Street, Cheetham, Manchester, wireless merchant; Mildred Kremner, "The Quest," Okeover Road, Broughton Park, Salford. Secretary: B. Leaver, 18, Kingsley Street, Nelson. Registered office: 78, King Street, Manchester.

Burovox (1931), Ltd.—Registered as a private company on March 20th. Capital, £1,000 in £1 shares. Objects: To acquire the goodwill, patents, trade marks (including the word "Burovox"), stock-in-trade and certain other assets of Burovox, Ltd. (in liquidation) and to carry on the business of manufacturers of and dealers in electrical or other apparatus for the transmission of messages or the reproduction of sounds, &c. The directors are: H. A. Dormer, 11, Queen Victoria Street, E.C., engineer; S. C. W. Smith, 66, Kensington Court, W.8, engineer. Registered office: 11, Queen Victoria Street, E.C.

Official Returns of Electrical Companies

Radio Experts, Ltd.—Capital, £500 in £1 shares. Return dated December 31st, 1930. 200 shares taken up. £200 paid. Mortgages and charges, nil.

Delagoa Bay Development Corporation, Ltd.—Capital, £166,300 in 267,400 ordinary shares of 10s. and 130,400 preference shares of 5s. each. Return dated December 17th, 1930. 267,400 ordinary and 68,400 preference shares issued and fully paid up. Mortgages and charges, £185,550.

Hart Accumulator Co., Ltd.—Satisfaction in full on September 30th, 1927, of debentures dated January 28th and July 5th, 1920, and registered February 11th and July 12th, 1920, securing £75,000. (Notice filed March 13th, 1931.)

Pullars Electric Co. (Brighton), Ltd.—Further charge dated March 4th, 1931, to secure £700 and further advances, charged on 105a, Hollingbury Road, Brighton, land with buildings thereon at rear of No. 95, and passage way between 95 and 97. Holder: R. Kelsey, Flat 4, No. 4, Third Avenue, Hove.

Julius Sax & Co., Ltd.—Capital, £10,000 in 3,000 7½ per cent. preference shares of £1 and 35,000 ordinary shares of 4s. each. Return dated December 23rd, 1930. 2,650 preference and 18,000 ordinary shares taken up. £5,051 paid on 2,650 preference and 12,005 ordinary shares. £1,199 considered as paid on 5,995 ordinary shares. Mortgages and charges, nil.

Whittaker Bros., Ltd.—Capital, £7,000 in 1,000 cumulative preference, 5,000 "A" ordinary and 1,000 "B" ordinary shares of £1 each. Return dated December 31st, 1930. 3,907 ordinary shares taken up. £3,207 paid. £700 considered as paid. Mortgages and charges, nil.

International Hydro-Electric Development Syndicate, Ltd.—Capital, £10,000 in £1 shares. Return dated December 31st, 1930. 2,744 shares taken up. £2,744 paid. Mortgages and charges, nil.

B.H.M., Ltd.—Capital, £5,250 in 5,000 preference shares of £1 and 5,000 ordinary shares of 1s. each. Return dated December 23rd, 1930. 3,751 preference and 2,850 ordinary shares taken up. £3,086 paid on 3,001 preference and 1,700 ordinary shares. £807 10s. considered as paid on 750 preference and 1,150 ordinary shares. Mortgages and charges, nil.

C. H. Hare & Son, Ltd.—Capital, £20,000 in 11,000 preference and 9,000 ordinary shares of £1. Return dated December 31st, 1930. 8,700 preference and 11,000 ordinary shares taken up. £12,202 paid. £7,498 considered as paid. Mortgages and charges, nil.

Barbados Electric Supply Corporation, Ltd.—Capital, £60,000 in £1 shares. Return dated December 1st, 1930. All shares taken up. £38,051 paid. £21,949 considered as paid. Mortgages and charges, £17,000.

City Notes

Clyde Valley Electrical Power Co.

Mr. C. Ker (vice-chairman) presided at the annual meeting held in Glasgow on March 18th. Reviewing the accounts Mr. Ker said the total capital expenditure was now about 3¾ millions, and the amount overspent on capital account was about £850,000. The accumulations at credit of contingency and other reserve funds, amounting to £1,834,000, had enabled them to finance this overspent capital without difficulty, but as the company progressed it might be necessary either to use part of their borrowing powers (£1,432,000) so far intact, or to apply to Parliament for power to issue additional capital. The proceeds of the sale of electricity had increased by £21,000. The depressed state of trade, which had affected the whole country, had hit their area of supply. Unemployment in Scotland during 1930 was nearly doubled, and of that the greater part was in the large industrial area which they served. The decrease in the number of units sold was ¾ of 1 per cent. The fact that this decrease was so small was due to two reasons: first, that in the earlier part of the year the depressed state of trade had not affected the company's sales; and, second, that there had been a satisfactory increase in the domestic supply, which had, to some extent, compensated for the falling away in the demand for power. The decrease in cash received amounted roughly to 3 per cent. This was due to a reduction in the average price of the electricity sold during the year. Further progress had been made with the scheme for the standardisation of frequency, and the cost to the end of the year amounted to £606,000. The directors had under consideration the incorporation in the company of the powers and orders of the Strathclyde Electricity Supply Co., Ltd., the Kilmacolm Electric Lighting Co., Ltd., and the Lanarkshire Hydro-Electric Power Co. The reasons for the separate existence of these companies no longer obtained, and there would be a considerable saving in accountancy if the subsidiaries—which were all owned by the company—were incorporated with the parent company. The prospects for the current year were not too encouraging, but they looked to the continued expansion of the domestic load to make up, to some extent at least, the loss of industrial load. The report and accounts were adopted.

British Insulated Cables, Ltd.

The accounts of this company were abstracted in our last issue, and the annual meeting was held on March 20th. Sir Alexander Roger (chairman), who presided, after referring to the death of Mr. Dane Sinclair, the late chairman, said they could not disregard the fact that competition at home and abroad was continually growing, and it was only by the maintenance of a really large turnover that sufficient profits could be earned to enable the company to make adequate provisions and provide satisfactory dividends. The cable manufacturing plant capacity in this country was in excess of the output requirements and with the average factory working on a low load factor the keenness for orders could be easily understood. There were many ways to meet competition, but the directors set their faces resolutely against a reduction of quality as a means of doing this. They considered the best way to meet the new conditions was to reduce costs and so offer lower prices to their customers. Much could be done in this direction by closer co-operation with other cable manufacturers whereby both manufacturing and administrative costs could be reduced, and in addition they felt that a policy of rationalisation should be followed. In pursuance of this policy the directors, in addition to the joint control acquired in a large cable manufacturing company in 1929, had during the past year purchased complete control of two other cable companies, one being of considerable size. They were constantly improving methods and machines and also extending research. For the moment their order book was not so good as last year, but in spite of depression the demand for electricity was growing in almost every direction, and this demand could not be met

without calling for the products of the cable industry. The purchasing power of the world was temporarily diminished and until the root causes of this were removed or mitigated, they could not, nor could any other industry, view the future without some anxiety. The report and accounts were adopted.

Scottish Power Co., Ltd.

Presiding at the annual meeting on March 20th, Mr. G. Balfour (chairman), in presenting the report and accounts, said the company now owned or controlled and operated 14 subsidiary companies and their operations covered 10 Scottish counties, the area of supply being approximately 5,500 square miles; they had laid or erected transmission lines to an aggregate length of about 1,160 route miles. The capacity of the plant installed in their various power stations totalled 80,500 kW, and the connected load was 92,681 kW. The electrical energy sold during the year amounted to over 77 million kWh. The most important addition to their investments during the year was the acquisition of the whole issued share capital of the Scottish Southern Electric Supply Co., Ltd. The Southern Scotland Electricity Scheme provided for the selection of the generating station of the Scottish Southern Co. at Galashiels as a "selected" station under the scheme. The Grantown-on-Spey undertaking had been purchased, and since the close of the financial year the whole of the preference shares and nearly all the outstanding ordinary shares of the Ross-shire Electric Supply Co., Ltd., had been acquired. The outstanding event of the year was the completion of the first development of the Grampians hydro-electric works. The supply from this station connected to all the transmission lines of the Grampian Co. and afforded a supply to the grid lines at Abernethy. They had contracted for an additional 50 million kWh, which necessitated the construction of the second stage of the Grampian scheme. This work had just commenced and was to be ready for service by December, 1933. The report and accounts were adopted.

Marconi International Marine Communication Co., Ltd.

The annual meeting was held on March 23rd, the Rt. Hon. F. G. Kellaway (chairman and managing director) presiding. In presenting the report and accounts (ELEC. REV., March 13th, p. 481), the chairman said that investments of £400,132 showed an increase of £20,625, which represented their participation in the Marconi Sounding Device Co. The company's revenue from its current contracts in respect of mercantile marine interests in the United Kingdom showed a falling off during the months of November and December, as compared with the corresponding months of 1929. Increased amounts brought in from their interests abroad, however, and new contracts secured during 1930 nearly counterbalanced this reduction; British mercantile marine provided the largest part of their revenue, and it was passing through the worst experience in living memory. The average yearly launches of ships from British yards which had compulsorily to be fitted with wireless was 250. Last year the number fell to 127. The percentage of ships laid up showed a considerable increase, but there were now signs of a slight reduction. They had entered into an arrangement with the Chamber of Shipping of the United Kingdom and the Liverpool Steamship Owners' Association under which they agreed to give a rebate of 6 per cent. to all shipowners who undertook to place at least 75 per cent. of their new wireless business with them for a period of five years. This agreement had been entered into by 85 per cent. of their customers. The Hon. Alexander Shaw, vice-chairman and joint managing director of the P. & O. Steamship Co., had been appointed to the board, and the Chamber of Shipping and the Liverpool Steamship Owners' Association had been asked to nominate a cargo owner to represent them on the board. The devices which they had produced in recent years had brought about a substantial reduction in the shipowners' running costs. The report and accounts were adopted.

Midland Electric Corporation for Power Distribution, Ltd.

Presiding at the annual meeting on March 20th, Mr. G. H. Nisbett (chairman), in presenting the report and accounts, said that they had expended during the year under review the sum of £70,634, nearly all of which was upon mains, transformers and meters. The power consumers had especially felt the effect of trade depression, but they had been able to more than replace the revenue so lost by a large addition to the number of lighting consumers. It was unfortunate that at a time when heavy additional charges for interest, &c., had to be met, the West Midlands Joint Electricity Authority should be faced with trade depression with a consequence that the demand for power had fallen far below what reasonable expectations of growth justified provision for. There could be no question that ultimately the formation of the Authority and the policy it was following would be amply justified. Negotiations which had proceeded with local authorities throughout the year had now reached concrete form, and had been submitted to the authorities in the form of a draft Special Order. The proposals in outline were that, in consideration of the extension of the company's franchise from the year 1940 to the year 1980, an initial all-round reduction of 10 per cent. on the basis of costs and revenue for 1928 should be allowed to consumers from the charges for electricity. Thereafter, a sliding scale, based on the company's actual costs from year to year would come into force. The Order was being considered by the local authorities concerned, but a final decision had not yet been reached. The report and accounts were adopted.

Bruce Peebles & Co., Ltd.

The report for the past year states that the results continue to be unsatisfactory, undue competition having again been experienced during the period. "The directors having carefully considered the position are of opinion that a sum should be taken from general reserve to meet the loss for the year. They recommend that no dividend be paid for the past year on either the preference or the ordinary shares. The preference dividend is cumulative to the extent of 7½ per cent. per annum." The trading loss is given as £29,511 (after transferring £1,027 from certain unrequired reserves). In the preceding year the fixed preference dividend was paid, but as the profits were insufficient to meet this the extra dividend of 2½ per cent. was not paid; the ordinary shares received 2½ per cent. Against the 1930 loss is placed a balance of £686 brought forward and £29,000 from reserve, leaving a credit balance of £175. The general reserve is reduced to £74,000. It is stated that the effect of the arrangement made with Brown, Boveri & Co., Switzerland, has not yet been felt, but the directors feel assured that the arrangement will eventually be of considerable value to the company. Since the beginning of the current year the position of the order book has improved considerably in all departments and the prospects are more promising. Towards the close of last year the directors found it expedient, for tariff and other considerations, to form a company in Canada to act as agents. The company holds the controlling interest in the Canadian company. The death of Mr. A. Mackenzie, a director, is recorded; it is not proposed to fill the vacancy at present.

Automatic Telephone Manufacturing Co., Ltd.

The annual meeting was held on March 20th, Sir Alexander Roger (chairman) presiding. In presenting the report and accounts the chairman said that substantial progress was made during the year with the equipment for the British Post Office of the two large provincial networks represented by the Manchester and Bristol telephone areas, while the Post Office had placed a contract with them for the equipment of three new 10,000-line exchanges in the London area. In association with other telephone exchange manufacturers they had entered into a contract with the Post Office for the bulk supply of telephone equipment for a period of years. Many contracts had been secured for exchange and transmission equipment from overseas, including South Africa, Northern Rhodesia, Tanganyika and Egypt. They were under contract to equip a number of towns in England with street traffic signals. A contract for their supervisory control equipment had been completed for the New Zealand Power Board, while other installations were on order for the L.C.C. Tramways, Manchester Corporation, &c. The manufacture of "Xcel" electric domestic and heavy duty heating and cooking equipment reflected healthy progression. During the year they had paid special attention to the development of larger canteen equipments. Regarding domestic cookers, they had collaborated with other manufacturers in the design and production of a standard model, embodying those features most favoured by municipal supply authorities. The report and accounts were adopted.

The annual meeting of the International Automatic Telephone Manufacturing Co., Ltd., was held on March 27th. Sir Alexander Roger again presided and made a similar review of the company's activities.

Cork Electric Supply Co., Ltd.

The accounts for 1930 show a total revenue of £78,135. Working expenses were £58,661, and after deducting debenture interest, and adding interest received (£11,898), and a balance brought in (£15,494), a total of £44,315 is available. The directors propose to pay a final dividend of 20 per cent. on the ordinary shares, making 25 per cent. for the year, leaving £776 to be carried forward. The company's electric lighting undertakings were compulsorily acquired by the Electricity Supply Board on April 3rd, 1930. A loss is again recorded on the tramway undertaking and it is to be abandoned on March 31st. The report states that the application to the High Court in Dublin for a declaration of the respective rights of the ordinary and preference shareholders was decided in favour of the ordinary shareholders, namely, that the preference shareholders were not entitled to participate in the surplus assets. This decision was appealed against on behalf of the preference shareholders, and it is hoped that the decision of the High Court will be made at an early date, as until this is recorded steps cannot be taken to liquidate the company.

Cambridge Electric Supply Co., Ltd.

The balance of net revenue account for 1930, including the amount brought forward is £31,920. The directors recommend a final ordinary dividend of 5 per cent., making 8 per cent. for the year, and the appropriation of £1,500 to the staff benevolent fund, leaving £4,953 to be carried forward. A call of 5s. per share was made during the year on the 140,000 ordinary shares of the 1929 issue, making these shares 10s. paid. The report states that Sir James Devonshire retired from the board during the year on account of ill-health. Mr. A. N. Rye, previously managing director, has been elected to the position of chairman, and Mr. A. Anderson to the office of managing director.

Notting Hill Electric Lighting Co., Ltd.

The directors' report for 1930 shows a profit, including £28,623 brought forward, of £99,790. After deducting debenture interest, &c., it is proposed to pay a final dividend on the deferred shares of 12s. 4.408d. per share, less tax, making a total of 17s. 4.408d. for the year, and to carry forward £32,590. The report states that in accordance with the terms of the co-partnership scheme, a bonus at the rate of 20 per cent. is again distributed to the employés. During 1930, electrical energy purchased in bulk was 13,036,756 kWh, as compared with 12,041,795 kWh, and the total sold was 10,235,134 kWh, as against 9,216,206 kWh.

Richmond (Surrey) Electric Light & Power Co., Ltd.

The report for the year ended December 31st last shows a profit of £45,962, to which is added £4,795 brought in, making £50,757. From this the following appropriations are made:—Sinking fund instalment, £1,419; change-over expenditure suspense account, £3,500; reserve for depreciation, renewals, &c., £10,000; general reserve, £10,000. A final dividend of 7 per cent. is recommended on the ordinary shares, making 11 per cent. for the year, leaving £3,838 to be carried forward. The electrical energy sold increased from 3,882,880 to 4,093,714 kWh.

Telegraph Construction & Maintenance Co., Ltd.

There was a further loss on working last year but the directors have transferred a sum from reserves not required, leaving a balance of £73,310. Adding £102,284 brought forward, the amount available is £172,594. From this a dividend of 7½ per cent., free of tax, is being paid (against 10 per cent. for 1929) and £105,364 is carried forward. It is stated that although orders improved as compared with the preceding year, the works were still not fully occupied throughout the year. The meeting was to be held yesterday (Thursday).

Salisbury Electric Light & Supply Co., Ltd.

The report for 1930 shows a balance on the year's working, after paying debenture interest, &c., and including the amount brought forward, of £12,049. It is proposed to pay a final dividend of 6 per cent., tax free, on the old ordinary shares, making 10 per cent. for the year, and to pay a dividend on the new shares for three months at the rate of 10 per cent. per annum, free of tax. The amount carried forward is £74.

Vickers, Ltd.

The net trading profit for 1930 was £1,173,269, and after deducting debenture interest, &c., there is a balance of £775,926. Reserve receives £100,000, and it is proposed to pay a dividend of 8 per cent., less tax, on the ordinary shares, the carry-forward being £231,970. The report records the death of Mr. G. G. Sim, deputy chairman, and the appointment of Col. J. B. Neilson to fill the vacancy on the board.

Windermere & District Electricity Supply Co., Ltd.

The revenue for 1930 was £15,031 and working expenses were £7,194, leaving a balance of £7,837, to which is added £1,092 brought forward and other revenue, making £10,051, from which are deducted debenture interest, interim dividends, &c., leaving £3,827. A final dividend is proposed on the ordinary shares of 5½ per cent., making 8 per cent. for the year, and £1,253 is carried forward.

Waste Heat & Gas Electrical Generating Stations, Ltd.

The report for 1930 shows a slight reduction in the net profit —£29,305 against £30,305. The addition of £22,330 brought forward gives an available balance of £51,635. The dividend is maintained at 8 per cent. and £26,035 is carried forward. Two stations—Ayresome and Clarence—have been closed since August.

Folkestone Electricity Supply Co., Ltd.

The net revenue for the past year was £60,514 (against £58,768 in 1929). The final dividend on the ordinary and employés' co-partnership shares is 6 per cent., again making 10 per cent., free of tax. The general reserve receives £15,000 as for 1929, but the contributions to depreciation and taxation reserves are increased.

British Aluminium Co., Ltd.

The report for the year ended December 31st last shows a net profit of £387,685, to which is added £35,559, making £423,245, and after deducting debenture interest the total available is £169,108. The final ordinary dividend (as mentioned in our last issue) is 6 per cent., making 10 per cent. for the year, less tax, the carry forward being £47,496.

Dundee, Broughty Ferry & District Tramways Co., Ltd.

The profit for 1930 (including £1,388 brought in) is £2,142, and after deducting debenture interest a balance of £1,038 is carried forward. The board recommends the acceptance of the offer of Dundee Corporation to purchase the undertaking for £25,000.

Torquay Tramways Co., Ltd.

The profit for the year ended December 31st last was £32,581, and after deducting debenture interest, &c., and adding £2,026 brought forward there is a balance of £28,008, from which the directors have made various appropriations, leaving £16,132. A final dividend of 5 per cent. is recommended, making 9 per cent. for the year, and £2,692 is carried forward.

Electric Bond & Share Co.

The net earnings for 1930 of this company, which controls the American & Foreign Power Co., were equivalent to $2.49 per share of common stock on the average number of shares outstanding during the year, compared with $2.22 earned on the average number outstanding during 1929.

Wisbech Electric Light & Power Co., Ltd.

The gross profit for 1930 was £7,662, to which is added £2,679 brought forward, making £10,341. After providing for depreciation, reserves, &c., it is proposed to pay a dividend of 10 per cent. on the ordinary shares, leaving £2,799 to be carried forward.

Ransomes, Sims & Jefferies, Ltd.

The directors state that, owing to difficult trading and manufacturing conditions, they are unable to announce the dividend due on the preference shares. Any question of dividend payment is to be deferred until the result of the year's trading has been ascertained.

Radio Corporation of America

The gross income for 1930, including wholly-owned subsidiaries, amounted to $137,037,596, and the net income was $5,526,293. After deducting "A" preferred stock dividend, the surplus was $320,294, making the total surplus at December 31st $30,010,538.

Brompton & Kensington Electricity Supply Co., Ltd.

A final dividend of 10.473d. per share has been declared, making the standard dividend for the year, at the rate of 8.5304 per cent. per annum.

Direct Spanish Telegraph Co., Ltd.

The final dividend on the ordinary shares is to be 3 per cent. free of tax, making 6 per cent. tax free for the year. The total dividends for 1928 and 1929 were 10 and 8 per cent., respectively.

Montreal Light, Heat & Power Consolidated

A dividend has been declared of 37 cents on the new common shares for the quarter ending March 31st. This compares with a payment of 60 cents in April last on the old shares before the issue of two new for one old.

Rangoon Electric Tramway & Supply Co.

A final dividend has been declared on the old ordinary shares of 1 rupee 4 annas, making 1 rupee 12 annas per share, free of Indian tax. The new ordinary shares issued during the year are to receive a dividend of 14 annas per share, free of tax.

German Company

The *Bergmann Elektricitätswerke A.G.* announces that no dividend is to be paid in respect of the past year. The 1929 dividend was 9 per cent.

Stocks and Shares

TUESDAY EVENING.

No fresh activity has developed in Stock Exchange markets. The approach of the Easter holidays is mentioned as an excuse for, or an explanation of, the quietude which prevails. There is no doubt, however, that the investor begins to take more interest in stocks and shares—interest, that is to say, of the favourable order which leads to purchases. In our own price-lists it is worth noticing how easily the deductions have been recovered that were made last week from the prices of Home electricity supply shares. The inquiry for purely investment securities is still a feature. London Power new debenture stock is better at 1¼ premium. Central Electricity Board has strengthened to 95. London and Home Counties 4½ per cent. debenture at 94½ retains its strength. Of the recently issued shares which are now quoted, Calcutta Electric have hardened to 7s. premium, Northampton Electric new shares are 9s. premium, and Electrical Distribution of Yorkshire 8s. premium.

Electric Lighting Profits

One of the principal financial weekly papers computes quarterly the profits of British industrial companies, and has within the past fortnight arranged to publish from time to time interim figures in advance of the complete service. In pursuance of this, the paper takes the total profits of companies whose reports have been received between January 1st and March 14th this year, with a comparison of the previous year for the same companies. In this group, the electric lighting section heads the list of net profit for the period. The companies show an increase of 7.3 per cent. net profit during the period mentioned, and gas companies, it may be of interest to note, an increase of 4 per cent. Out of the twenty sections into which the list of companies is divided, five show an increased profit.

Home Electricity Supply

Mention has already been made of the recovery of dividends deducted last week from prices of shares in the Home electricity list. These include Charing Cross ordinary, County of London, Kensington, London Electric, and Metropolitan, while in the provincial group, Clyde Valleys and Lancashire Light and Power both show improvements. Brompton & Kensington declares its usual dividend, and Notting Hill deferred shares receive for the year 17s. 4d. Richmond (Surrey) is paying 7 per cent., the same as before, making 11 per cent. for the year. The price of the shares has recovered to 43s. 6d. Egham

and Staines, at 40s. 6d., are a few pence lower. City of London ordinary shares are better at 37s. 6d. On the other hand, a slight decline took place in Isle of Thanet preference, lowering the price to 23s. Amongst overseas issues, Calcutta Electrics have been 40s. 9d., but reverted to £2. Victoria Falls ordinary further advanced to 48s. Atlas ordinary are 1 and the preference 24s. 4½d. British Power & Light keep at half-a-sovereign.

Tube Railway Stocks

Central London assented ordinary is a point lower at 77, and Underground Electrics continue dull at 22s. The London Electric, the District, and the Central London companies have petitioned the House of Lords for leave to introduce a late Bill to extend the Bakerloo Railway. This petition is to be examined on Thursday in the present week. An expenditure of over 3 million pounds is evidently contemplated, for power is to be sought to raise additional monies. The feature amongst London traction stocks is a gain of 3 points, to 65½, in London United Tramways 4 per cent. debenture.

Cables and Wireless

Cables and Wireless stocks are weaker, the 5½ per cent. preference going back to 67¼, and the "A" ordinary to 23½. The traffic receipts published by the Imperial & International Communications show a decrease of £69,600 for February as compared with the same month last year, but the figures, compared with January, and calculating the daily receipts, show a slight advance. It must be remembered, also, that the rates have been reduced from those of a year ago. Clearly, however, the expected revival in trade is not yet exercising any marked effect upon the Cables & Wireless traffics.

Telegraphs and Telephones

Globe Telegraph & Trust ordinary are ex the dividend of 3s. 6d. net, which compared with 5s. paid twelve months ago, but the price of the shares is left at 12½ xd. Great Northern Telegraphs hardened to 30¼. The Anglo-American group shows no alteration. Cable stocks as a whole are attracting for the moment but little public notice. American Telephone and Telegraph at 200 is ex dividend, and so also is International Telephone & Telegraph at 37¾. Automatic Telephones are steady at 37s. 6d. International Automatic Telephone shares are quiet at 35s., the "B" deferred being still a florin under the ordinary. The company's meeting was held on Monday last, and the chairman referred to the General Telephone & Electric Corporation, which was formed, it may be remembered, to assist in the way of financial and technical resources.

Marconi Marines

Marconi Marines hold their rise at £2. Mr. F. G. Kellaway, chairman, at the meeting this week, claimed that installation of wireless telegraphy and telephony at sea contributes materially towards reduction of costs in running a ship. He was able to add that 86 per cent. of the Marconi Marine's customers had agreed to place at least three-fourths of their new business with the company for a period of five years.

Dollar Stocks

Brazilian Traction shares are flat at 23, showing a fall of 5 points on publication of the net earnings for February, a drop of some $340,000 as compared with those of February, 1930. This decrease continues the shrinkage shown by the January figures, and arouses a fear lest the company may pass its dividend. American and dollar stocks are, as a whole, weaker, except as regards some of the utility shares, where slight improvements have occurred. Power Corporation of Canada, for instance, are better at 64½, a gain of 3½ points. Shawinigans at 59½ are 1½ down, and the disposition of the New York stock market has been weak.

Buenos Ayres Lacroze 5 per cent. consolidated debenture at 61½ is 6 points down. Mexico Tramways 6 per cent. bonds weakened to 22½. On the other hand, Mexican Light & Power common and preferred shares have enjoyed substantial rises.

Manufacturing and Equipment

The Telegraph Construction and Maintenance Company shows in its report another trading loss, following upon that of last year, but there is a balance of £70,000 after writing back a sum for reserves not required. The company must be obviously in an exceedingly strong financial position for the board to be able thus to draw upon reserves in two consecutive years for dividend-equalisation purposes. The present experiences testify to the prudence of the directors in having conserved resources as they have done in the past, in spite of pressure occasionally brought to bear upon them with a view to the distribution of larger dividends when the business was prospering. British Aluminium ordinary shares are a little lower at 30s. The accounts show that the issued capital now totals just over two millions in £1 shares, almost equally divided between the preference and ordinary. There is, of course, a substantial debenture issue. Associated Electrical Industries are a little lower, in sympathy with the tendency of New York. G.E.C. ordinary, however, remain at 46s. 3d. Enfield Cable ordinary shares at 4⅜ have recovered the deducted dividend. Philips Glowlamp Works are lower at 2 1/16. Crompton Parkinson ordinary gave way to 21s. 3d. The iron and steel market is, on the whole, better, on account of the maintenance of its 8 per cent. dividend by Vickers, Ltd. Babcock & Wilcox further strengthened to 52s. The rubber market is inactive and dullish.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom.	Approx. Dividend. 1929.	1930.	Price March 24 1931.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	3	—	5 0 0
Brompton Ordinary	1	8½	8½	28/6	—	4 18 3
Central Electricity 4½% Deb. ...	Stock	—	—	94½	—	4 15 8
Charing Cross Ordinary	1	8½	8½	29/6xd	+⅛	4 15 0
Chelsea	1	8¾	8¾	28/-	—	5 0 0
City of London	1	10	10	37/6	+⅛	5 6 8
Clyde Valley	1	8	8	34/6xd	+9d.	4 12 9
County of London	1	7	10	47/6xd	—	4 4 0
Edmundsons' 7% Pref.	1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	1	11	11	48/-	+6d.	4 11 7
Kensington Ordinary	1	8	8	39/-xd	+6d.	4 16 7
Lancs. Light and Power	1	7½	7	24/-	+6d.	5 16 8
London & Home Counties 4½% Deb.	Stock	—	—	94½	—	4 15 3
London Electric	1	8½	9	33/-xd	+6d.	5 9 1
Metropolitan	1	9	10	40/9xd	+9d.	4 18 1
Midland Counties	1	6½	7	28/-	—	5 0 0
Mid. Elec. Power	1	15	8	31/3	—	5 2 5
Newcastle-on-Tyne Ordinary ...	1	6	6	28/3	—	5 6 8
do. 7% Pref.	1	7	7	27/6	—	5 1 10
Notting Hill 6% Pref.	10	6	6	11½	—	5 6 8
North Met. Elec. 6% Pref. ...	1	6	6	24/-	—	5 0 0
St. James' and Pall Mall	1	8	8	28/6xd	—	4 18 3
Scottish Power	1	8	8	29/6	—	5 8 6
South London	1	8½	8½	28/-	—	5 0 0
Urban Ordinary	1	7	7	27/6	—	5 1 10
Westminster Ordinary	1	8¼	8¼	38/6	—	4 18 3
Whitehall Elec. Invst. 7½% Pref....	1	7½	7½	25/-xd	—	6 0 0
Yorkshire Elec.	1	8		32/6	—	4 18 6

HOME RAILS.

Central London Ord. Assented ...	Stock	4	4	77	—1	5 4 0
Metropolitan	,,	4	3½	55½	- 1	6 6 3
do. District	,	5	5	73½	—	6 16 8
Underground Electric	£1	8	8	22/-	—	7 2 3

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	106½	—	5 16 0
do. Def.	,,	1½	1½	28½	—	5 15 6
Automatic Telephone	1	12½	12½	37/6	—	6 13 4
Cables & Wireless 5½% Pref. ...	Stock	5½	—	67½	—2	8 3 0
do. A 7½% Ord.	,,	—	—	23½	—½	... ...
do. B Ord.	,,	—	—	12½	—¼	... ...
Globe Tel. and T. Ord.	10	10	—	12½xd	+3/6	... ...
do. do. Pref. ...	10	6	6	10½xd	—	5 15 5
Great Northern Tel.	10	20	20	30¾	+⅛	6 12 4
Marconi-Marine	1	15	15	40/-	—	7 10 0
Oriental Telephone Ord.	1	12	12	23⅜	—	*5 1 8

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref. ...	5	5½	—	1½	—	... ...
do. do. 2nd Pref. ...	5	6	—	15/-	—	... ...
do. do. 5% Deb. ...	Stock	5	5	42½	—	11 15 3
British Electric Traction Def. Ord.	,,	5	5	1350	—	... ...
do. do. Pref. Ord.	,,	8	—	131½	—	6 1 3
Brazil Traction	100	8	—	23	—5	... ...
Brit. Columbia Elec. Rly. Pce. ...	Stock	5	5	97½	—	5 3 1
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/6	—	... ...
London United Tram Deb. ...	Stock	4	4	65½	+3	6 3 2
Mexico Trams, 5% Bonds ...	—	5	5	49½	—	10 2 0
Mexican Light Common	100	Nil	Nil	62½	+10	... ...
do. 7% Pref.	100	7	7	74½	+7	9 8 0
do. 1st Bonds	—	5	5	79	+1	6 6 7
Victoria Falls Ord.	1	15	15	58/-	+6d.	5 3 5
Yorkshire (West Riding)		Nil	Nil	5/6	—	... ...

MANUFACTURING COMPANIES.

	1928.	1929.			
Assoc. Elec. Ord.	1	6	6	22/6	—¢d.	5 6 8
Babcock & Wilcox	1	18	15	52/-	+9d.	*3 15 5
British Aluminium Ord.	1	10	10	30/-	- 1/-	6 9 0
British Insulated Ord.	1	15	15	3½	—	4 18 6
Brush Ord.	Stock	10	10	105	—	9 10 0
Callenders	1	15	15	3	—	5 0 0
do. 6½% Pref.	1	6½	6½	25/-	—	5 4 0
Crompton Parkinson Ord.	5/-	—	30	1½xd	—½	7 1 3
do. 8% Pref.	1	8	8	28/-xd	+6d.	5 14 5
Edison-Swan 1st Pref.	1	7½	7½	23/9	—	6 6 4
do. 5% Deb.	Stock	5	5	94½	—	5 5 10
Electric Construction	1	5½	5	11/9	—	8 10 9
Enfield Cable Ord.	1	20	25	4⅜xd	+⅛	5 14 9
English Electric	1	Nil	Nil	6/3	—	... ...
do. do. Pref.	1	3	Nil	6/3	—	... ...
Ferranti Pref.	1	7	7	21/6	—	6 10 4
G.E.C. Pref.	1	6½	6½	25/6	—	5 2 9
do. Ord.	1	10	14	46/3	—	6 1 3
Henley	1	25	30	5½	—	5 9 1
do. 4½% Pref.	5	4½	4½	4¼	—	5 6 9
India-Rubber	1	Nil	Nil	5/-	—	... ...
Johnson & Phillips	1	10	10	36/9	—	5 8 10
Siemens Ord.	1	7½	7½	1½	—	7 1 3
Telegraph Construction	12	10	10	16½	—	... ...

*Dividends paid free of Income Tax.

United States Electrical Exports

Figures for 1929 and 1930 Compared

BELOW are shown the values of electrical machinery and apparatus exported from the United States during the 12 months ended with December last. Comparative figures for the year 1929 are added, and notes of increases or decreases are also given, except in a few instances (marked by asterisks) where the classification has been recently subdivided :—

	1929. Thous. $	1930. Thous. $	Inc. or dec. Thous. $
Electrical machinery and apparatus (total)	130,063	119,018	−11,045
Generators—			
Direct current—			
Under 500 kW	1,290	744	− 546
500 kW and over	860	460	− 400
Alternating current—			
Under 2,000 kVA	295	310	+ 15
2,000 kVA and over	310	660	+ 350
Steam turbine generator sets	1,020	1,600	+ 580
Accessories and parts for generators	980	708	− 272
Arc welding sets	*	440	—
Self-contained lighting outfits	1,190	846	− 344
Batteries—			
Flashlight batteries	3,460	3,620	+ 160
Radio B. & C. batteries (dry)	1,030	580	− 450
No. 6 dry cell batteries	*	580	—
Six-volt storage batteries	*	1,810	—
Other primary batteries	1,710	270	− 1,440
Other storage batteries	*	1,290	—
Transforming or converting apparatus—			
Power transformers, 500 kVA and over	1,350	2,010	+ 660
Distribution transformers, less than 500 kVA	1,300	1,860	+ 560
Instrument transformers	155	240	+ 85
Battery chargers, under 15 amps.	235	150	− 85
Other transformers	1,450	1,180	− 270
Rectifiers, double-current, and motor generators, dynamotors, synchronous, and other convertors	1,280	1,150	− 130
Transmission and distribution apparatus—			
Switchboard panels, except telephone	1,180	2,160	+ 980
Switches and circuit breakers over 10 A	2,300	2,390	+ 90
Fuses	570	380	− 190
Watt-hour and other measuring meters	1,270	730	− 540
Indicating instruments	700	830	+ 130
Recording instruments	325	450	+ 125
Other testing apparatus	1,050	920	− 130
Lightning arrestors, choke coils, reactors and other protective devices	995	850	− 145
Motor starters and controllers—			
Motors, ½ h.p. and under	2,700	2,410	− 290
Motors over ½ and under 1 h.p.	780	660	− 120
Stationary motors			
1 to 200 h.p.	4,250	3,390	− 860
Over 200 h.p.	400	690	+ 290
Railway motors	300	200	− 100
Electric locomotives—			
Railway	660	870	+ 210
Mining and industrial	470	740	+ 270
Station and warehouse electric motor trucks	190	280	+ 90
Starting and controlling equipment—			
For industrial motors	1,990	1,650	− 340
For electric railway and vehicle motors	205	160	− 45
Portable electric tools	1,360	1,210	− 150
Accessories and parts for motors	3,490	2,410	− 1,080
Radio apparatus—			
Transmitting tubes, sets and parts	1,940	1,140	− 800
Receiving sets	9,780	11,550	+ 1,770
Radio receiving tubes	2,000	2,360	+ 360
Receiving set components	4,420	4,375	− 45
Other receiving set accessories	2,700	2,830	+ 130
Loud-speakers	2,230	1,690	− 540
Telephone apparatus—			
Telephone instruments	980	530	− 450
Telephone switchboards	1,626	950	− 676
Other telephone equipment	3,960	3,890	− 70
Bells, buzzers, annunciators and alarms	400	350	− 50
Telegraph apparatus	1,070	760	− 310
Electrical appliances—			
Electric fans	1,190	1,050	− 140
Health exercisers	*	124	—
Electric lamps—			
For motor cars, flashlights and Christmas trees	*	194	—
Other	*	1,017	—
Other electric lamp bulbs	635	270	− 365
Flashlight cases	2,590	1,380	− 1,210
Searchlights and projectors	570	520	− 50
Flat irons	380	270	− 110
Cooking ranges	350	440	+ 90
Household washing machines	2,000	1,710	− 290
Vacuum cleaners	1,490	1,720	+ 230
Other motor-driven devices, except tools	1,130	820	− 310
Industrial electric furnaces and ovens	1,010	1,010	—
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, &c.	1,950	1,600	− 350
Other electrical apparatus—			
Spark plugs	2,100	1,700	− 400
Other starting, lighting, and ignition apparatus	1,850	1,360	− 490
Insulating material	1,490	1,120	− 370
Metal conduit, outlet, and switch boxes	1,550	1,210	− 340
Sockets, receptacles and lighting switches	2,130	1,800	− 330
Electric interior lighting fixtures	2,620	2,160	− 460
Electric street lighting fixtures	630	500	− 130
Other wiring supplies and line material	1,450	1,550	+ 100
Other electrical apparatus	13,470	10,040	− 3,430
Insulated iron or steel wire and cable	390	215	− 175
Insulated copper wire and cable	6,180	4,640	− 1,540

A Novel View of Electrical Brooders

A worthy lieutenant-colonel, writing to a leading poultry magazine recently, has made an interesting discovery relating to electricity. Used discreetly by the earnest propagandist, this discovery should be a load builder.

Rearers of chickens experience every year more or less trouble from cannibalism. Chicks of the tenderest age, in circumstances which are still obscure, will peck each other to death, and outbreaks of cannibalism may occur quite suddenly at any stage of the period of rapid growth.

The introduction of "battery brooders," that is to say, aggregations of heated cages in which thousands of chickens are reared through the first few weeks of life, has been thought by some to have increased the incidence of cannibalism. As a rule these brooders have been heated by means of coal- or oil fired boilers through a system of hot water pipes, but our gallant colonel heated his battery brooders electrically and has no doubt at all that his freedom from cannibalism is connected intimately with that fact. He is one of your thoroughly practical men with no scientific nonsense about him. No one in his senses, says he, would attempt to explain the magnetic compass solely in terms of the magnetic needle, yet that is what science (*sic*) is trying to do with regard to most poultry problems. "As everyone knows, one can test whether a torch battery is charged by licking the leads and seeing if there is a salt taste. What I believe is, that electrical heat is fundamentally a dead mineral heat with a sort of saltness about it (at least where the heating element is not enclosed in glass) that satisfies the birds and removes the desire for salt that is normally expressed in cannibalism. . . . My observations and experiments have led me to believe that there are differences in heat according to how it is originated, which are not suspected at present by orthodox science."

This profound thinker desires more attention to be paid to possible terrestrial influences. "One very obvious difference, for instance, between England and America is the magnetic variation. Nobody seems to have considered the possibility that this variation may cause a subtle difference in life in these two countries, so that scientific experiments in America on, say, vitamins, may not necessarily be true for the British Isles."

It would be a pity to comment upon the foregoing, but it would make a good text for a lecture upon the muddled working of the unscientifically trained mind.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

An Inspection Lamp

A new electric inspection hand lamp known as the "Gripper" has lately been put on the market by S. SMITH & SON, LTD., Cricklewood, N.W.2. The main feature of the lamp is the provision of a gripping jaw device which allows the lamp to be fixed in any handy position, so leaving the hands entirely free. Chiefly intended for use in garages and motor repair shops, it will also be found useful by electrical engineers.

A Small Lighting Projector

The accompanying illustration is of a small floodlighting fitting of the precision type for wide angle lighting recently produced by the LONDON ELECTRIC FIRM, Brighton Road, South Croydon, Surrey. It is fitted with a novel optical arrangement comprising two silvered-glass mirrors and a lens, so positioned that practically the whole of the light from the filament of a 500-W gasfilled lamp, for which the apparatus is designed, is utilised and definitely directed into the angle of the beam. One of the uses of this projector is for airway lighting as a "course light."

"L.E.F." Projector

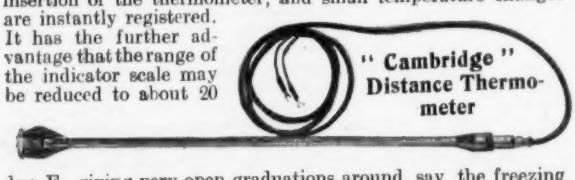
A Novel Lamp

In a recent issue of the Russian electrical journal *Electritchestvo*, No. 22, 1930, Mr. P. V. Behherev illustrates and describes at length a new design of incandescent lamp, the feature of which is a small reflector within the bulb and above the horizontal portion of the filament. The article gives the results of a number of tests on this lamp, diagrams being included to show the increased lighting capacity that it is possible to obtain by its use.

A Distance-thermometer Element

The CAMBRIDGE INSTRUMENT CO., LTD., 45, Grosvenor Place, London, S.W.1, has recently developed a new thermometer element which may be used in connection with its electrical distance thermometer outfits. It comprises a coil of platinum wire suitably encased and provided with terminals. The resistance of the element at different temperatures is measured on a galvanometer which embodies a modification of the Wheatstone bridge, and is compared with other resistances which do not change with temperature, their value being so adjusted that the bridge is balanced at the commencing temperature of the range of the galvanometer. Any increase in the temperature of the element then causes the galvanometer pointer to move over a suitably calibrated scale. The indicator is robust in construction, all sensitive parts being protected from dust, moisture, or fumes by a substantial metal case. Single-point or multi-point indicators are made, the latter being arranged for either 6, 12, or 18 points; a multi-way switch enables any thermometer to be put in circuit at will. The new element rapidly responds to temperature changes, steady readings of any temperature within the range of the indicator being obtained in about 4 seconds after the insertion of the thermometer, and small temperature changes are instantly registered.

It has the further advantage that the range of the indicator scale may be reduced to about 20 deg. F., giving very open graduations around, say, the freezing point, or any other selected temperature. These thermometer elements can be employed in conjunction with single wall-pattern indicators, or with portable indicators, for any applications where instantaneous readings of changes in temperature are desirable. They were fitted recently on the ill-fated Airship R.101 for recording atmospheric temperature variations. The method of mounting the thermometer element is varied, however, in accordance with the conditions under which it is to be used.



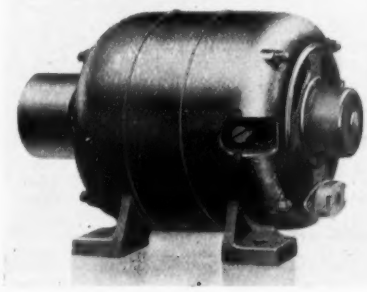
"Cambridge" Distance Thermometer

An Improved Prepayment Meter

Since the publication of a description of the "Rex" fixed-charge automatic collection and prepayment meter in our issue of November 8th, 1929, p. 830, several improvements have been incorporated in the apparatus. An important addition is a substantial earthing terminal. The meter now operates so that of 1s. inserted 9d. goes as an instalment off the fixed charge, the balance of 3d. being available for the purchase of energy, until the fixed charge is paid up, when the meter acts as ordinary prepayment apparatus; other ratios available are 8d.—4d. and 10d.—2d. Should the consumer wish to hire additional apparatus or get any other assistance which may result in an increase in his fixed charge, no alteration is necessary to the meter, apart from a slight adjustment which can be done in a minute by the collector. The gearing is now so arranged that should, say, 25 per cent. of the last coin only be needed to clear the fixed charge, the remaining 75 per cent. is credited to the coin reserve. The meter occupies small space and has a clean front with no projecting parts. The "Rex" meter is marketed in this country by Thompson & Co., 1 and 3, Old Swan Lane, E.C.4.

A Fractional H.P. Motor

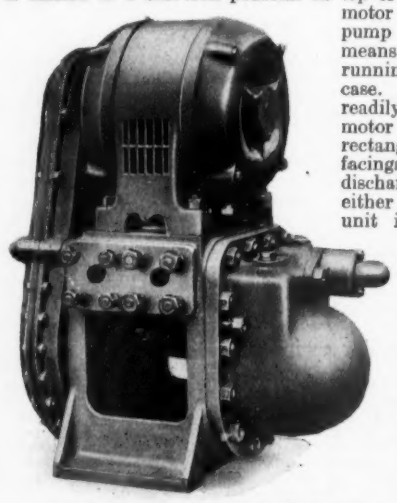
Newcomers into the field of British manufacturers of fractional h.p. motors are CROMPTON PARKINSON, LTD., Bush House, Aldwych, W.C.2, who have introduced the "Crompton Minor," made in the repulsion-induction type for a.c. and in compound-wound style for d.c. The range covers seven sizes from ¼ to 1 h.p., inclusive, drip-proof enclosures being standard. The machine is attractive and free from projections and dust-collecting re-entrant angles. Large sleeve bearings are fitted, with felt-pad and wool-yarn lubrication. Efficient means are provided to prevent the escape of excess oil to the windings, but sufficient oil is held to last for many months of continuous operation. In motors required for wall or ceiling mounting the bearing housings can be rotated. The a.c. motors are fitted with simple and robust short-circuiting and brush-lifting devices which are free in both the starting and running positions. Carbon brushes of large area, fitted with pigtails, are carried in substantial holders. A.c. motors can be reversed simply by rocking the brushes to the alternative of two marked positions, while reversal of the d.c. machines is obtained by altering the connections in the terminal box, this being in a convenient, protected position, and suitable for the use of flexible leads or conduit.



The "Crompton Minor"

A Fuel-oil Pressure Pump

The "Pyro" pump has been specially developed by G. & J. WEIR, LTD., Cathcart, Glasgow, for supplying fuel oil for pressure oil-burning systems. The pump is of the two-stage gear type and very compact. The unit containing the rotors is carried in a cast-iron pedestal on top of which the electric motor is mounted, the pump being driven by means of a roller chain running in an oil-tight case. All the parts are readily accessible. The motor pedestal is of rectangular form, with facings for suction and discharge connections on either side. The pump unit is contained in a simple casing with a single flat joint where it is bolted to the pump seating. By breaking the single joint of the casing the interior of the pump can be examined, clearances tested and renewals effected, without breaking any pipe joints or disturbing the motor or drive.



"Weir Pyro" Fuel-oil Pump

A totally-enclosed excess-pressure relief valve is incorporated in the upper part of the pump casing. The pump rotors are arranged in series, thus reducing leakage losses and giving a high volumetric efficiency. For variable-speed machines a.c. slip-ring motors have variable resistances in the rotor circuits to give all between half and full speeds, while d.c. motors employ either shunt regulation for all between half and full speeds, or they have series resistances in combination with shunt regulation, giving all between quarter and full speeds. The pump is built in a range of sizes with capacities varying from 70 to 1,630 gal. per hour, equipped with motors of ¾ h.p. (1,440 r.p.m.) and 7 h.p. (960 r.p.m.), respectively.

The Societies and their Doings

Apart from I.E.E. activities, the subjects dealt with this week are steam boiler corrosion, overhead-line difficulties, sound reproduction, the 1930 E.D.A. report, the art of illumination, and commercial engineering in South Africa

The Institution of Electrical Engineers

ATTENTION is directed to the undermentioned announcements relative to recent functions :—

Summer Meeting.—The annual conversazione will not take place this year until September. It will form part of the Faraday centenary celebrations and the annual summer meeting of the Institution, which are to be held in London; an attractive programme of visits and other functions is being prepared.

Scottish Centre Committee.—The following gentlemen have been nominated to fill the local vacancies that will occur in September next. Chairman: Prof. G. W. O. Howe; vice-chairmen: Messrs. J. C. Macfarlane and D. H. Bishop; new ordinary members of committee: Messrs. H. Bell, D. M. Macleod, H. C. Babb, and D. McLennan.

War Memorial Prize.—The prize which was founded by members of the Royal Indian Engineering College, Coopers Hill, in commemoration of members of the College who fell during the war is awarded annually by the Institution of Civil Engineers and triennially in turn by the Institution of Electrical Engineers, the School of Military Engineering (Chatham) and the School of Forestry (Oxford). It consists of a bronze medal, a parchment certificate of award, and about £25, awarded for the best paper on a professional subject. The triennial award falls this year to the Institution of Electrical Engineers which has selected the following ten subjects, and members are invited to submit for consideration a paper on any one of them: "The Use of Electricity in Public Works," "Hydro-electric Power Developments," "Electrification of Railways," "Electricity in Agriculture," "Electricity in Mines," "Long-distance Telephony (excluding Wireless)," "Long-distance Telegraphy (excluding Wireless)." "Overhead Lines in Rural Districts," "Extra High-voltage Underground Cables and their Protection," "Empire Wireless Communications." Papers submitted must be specially written for the purpose of the competition and reach the secretary of the Institution not later than October 1st, 1931. Only corporate members who were under 35 years of age on January 1st, 1931, are eligible.

South-Midland Centre Committee.—The following nominations of officers for the 1931-32 session are announced. Chairman: Mr. N. B. Rosher; vice-chairmen: Messrs. J. Morton and J. Coxon; new members of committee: Messrs. W. Burton and F. H. Clough.

Tees-side Dinner.—There was a large attendance at the annual reunion dinner at Middlesbrough of the I.E.E. TEES-SIDE SUB-CENTRE, over which MR. H. G. A. STEDMAN, chairman, presided.

MR. E. W. JACKSON, in proposing the principal toast, remarked that this was the diamond jubilee year of the Institution, which could proudly boast a membership of over 14,000, a number not exceeded by any other technical society and one which called for unqualified congratulation.

MR. C. C. PATERSON, president, who replied, suggested to members that the Institution had got to review its conception of what an electrical engineer was.

MR. J. M. GIBSON, past chairman of the sub-centre, proposed the toast of the guests, to which MR. H. RENDLE, the chairman of the Tees-side section of the Electrical Power Engineers' Association, replied.

Shipbuilders Consider Steam Boiler Corrosion

CORROSION, chiefly considered in its relation to steam boilers, formed the subject of MR. T. MILLICAN'S NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS paper, which deals with the various theories which have been advanced in explanation of its causes, some of the theories being supplemented or altered in the light of recent research. Effects are shown to be of various forms, but that which is most destructive to boiler plates is, unfortunately, pitting, which is that most generally met with. It is shown that when incrustation is allowed to form on the boiler heating surfaces there is a definite tendency to support corrosion, due to differential aeration. Mention is made of a case considered unusual, but it might prove not to be so unusual if investigation were more universally thorough where decarburisation of the surface of the metal was found to be due to overheating. Cases of corrosion in general are considered in respect of those types of boilers most commonly met with in practice and, although methods of prevention are mentioned, having due regard to the danger of producing conditions which may give rise to caustic embrittlement, it is considered that probably each case of corrosion is a law unto itself and should receive thorough individual investigation.

The electrolytic theory is now generally accepted as the one which best explains the important established facts. Iron is, to some extent, soluble in water, but it can only enter solution by displacing some other element already in solution; hydrogen is the element displaced and it gathers on the surface of the metal to form a thin protective film, the presence of which prevents the continuance of the reaction by sealing the metal from the solution. If it could be retained in this form, corrosion would proceed no further than the first very limited stage; unfortunately, however, the film is readily dissipated either by combination with oxygen or by escaping as a gas. Dissolved oxygen is invariably present, and it removes the hydrogen film by combining with it to form water, thus enabling more iron to go into solution. The process can continue at a rate proportional to that at which the oxygen removes the hydrogen. In an acid solution the same reaction takes place, the tendency being much greater, so that corrosion is proportionately more rapid than in neutral or alkaline waters.

Factors influencing the rate of corrosion are so numerous as to be confusing; although not affecting the tendency to corrode, secondary factors may have an effect on the amount and distribution of the action. Primary factors are (1) metal potential or solution tendency of the iron, which is determined by the normal potential of the metal and the concentration of metal ions in the solution, hydrogen acting as a metal (*i.e.*, when brought in contact with a solution gaseous hydrogen exerts a solution pressure like that of a metal); (2) the potential available for the deposition and removal of hydrogen, as determined by the hydrogen-ion concentration of the solution, and the normal potential of hydrogen.

The fact that a metal tends to corrode under a certain set of conditions does not necessary mean that an appreciable amount of corrosion will take place. Aluminium, for instance, has a strong tendency to corrode in distilled water, but the amount of corrosion is small because of the early presence of a protective film of oxide. The tendency to corrode having been established, however, the secondary factors which control the transfer of oxygen to the metal are of importance. The difficulties in an attempt to analyse the tendency becomes evident when the great number of external factors is considered, particularly when under certain conditions any one of these factors may become controlling. Factors which play important parts in controlling the rate of corrosion under one set of conditions may be of little consideration under other conditions. Such variations account for the many faulty ideas on the subject.

Some Weaknesses and Difficulties of Overhead Power Lines

AT the March monthly meeting of the OVERHEAD LINES ASSOCIATION in London a discussion took place concerning difficulties encountered in the erection, operation, and maintenance of overhead lines.

MR. W. C. BEXON (president), who opened the discussion with a short paper in which he recounted snags encountered in the Ayrshire district, said that, so far as lightning protection of extra-high-voltage lines was concerned, he had found the film type of arrestor effective. As regarded protection against surges, a great deal of research was necessary; surge arrestors had been put on the market, but they were expensive. As regarded trouble from birds, he had been compelled to try several devices; one was the use of special insulation on the cross-arms, another was to insulate the wires for a distance of 2 ft. on either side of the insulators. Nevertheless, bird trouble continued. On a six-wire line he had had a special bird guard made of porcelain, which covered the insulator and the wire for a distance of 2 ft. on either side, but nevertheless at particular times of the day the automatic switches invariably tripped. The trouble was due to a large number of crows resting on the wires at the centre of the span and when the birds flew off together the wire swung up and caused a short circuit between phases through the birds. This was overcome by extending the middle cross-arm a further 2 ft., thus making the phases not on a vertical plane. He had had a special type of insulator constructed to deal with salt deposit trouble on h.p. lines near the sea. In one case a 25,000-volt line was equipped with 33,000-volt insulators, but they flashed over at 11,000 volts.

One of the biggest difficulties on e.h.p. lines had been pole trifurcating boxes breaking down due to the compound shrinking and allowing moisture to get in, or to malicious persons breaking the insulators. Within the last few years, however, a new arrangement for terminating underground mains and connecting to overhead lines had been adopted which was more satisfactory, but there were still weaknesses. It would con-

siderably cheapen supplies in rural areas if there were no necessity anywhere to go underground when passing Post Office lines and railways. In isolating switches he still found weaknesses, one being that the flexible wires deteriorated and fractured to form an open circuit or an earth. Pole transformers were still a source of weakness due to moisture getting in. Faults on low-voltage overhead lines were not so numerous as they were a few years ago. If the Electricity Commissioners would grant permission to erect a high-voltage feeder on the same poles as a low-voltage feeder without costly and extravagant safeguards, it would be very helpful. It was best to place fuses at a point where the service was connected to the overhead distribution; they could be erected while the line was in progress of erection and so avoid difficulty in connecting up the service.

In conclusion, Mr. Bexon asked all the members to send to the O.L.A. hon. secretary details of any troubles they had encountered, as a collection of such information would be of great value in framing a specification for overhead lines.

MR. R. BORLASE MATTHEWS asked whether the President had ever used combined insulators and fuse holders, without detachable fuses for the entrance to houses.

MAJOR THEODORE RICH said that the wires of high-voltage lines on the Continent were not vertically above each other so that one wire could not bounce up and touch another; in some parts of Germany, indeed, the conductors were in a horizontal plane. On the Continent they were erecting pole lines with hinged arms, so that if there was any stress on one side the arm would give. Had glass insulators been used in Scotland?

MR. W. FENNELL pointed out that a fuse known as the Yorkshire type was very good, but it cost 5s. or 6s. more per service. In his area he joined the services for four or five consumers and put one of those fuses at the point of origin, in which case the extra cost was justifiable. High- and low-voltage wires on the same poles were allowed by the Electricity Commissioners in his area and he believed they would sanction any reasonable proposition of that kind. The salt trouble was a serious one; about three years ago he had spent £4,000 on changing all his 33,000-volt insulators to what might be called 66,000-volt insulators and there had been no trouble since. He had installed peroxide arrestors nearly 2½ years ago in a certain locality and, although he had no means of knowing whether they had worked, there had been no trouble on the high-pressure side of the transformers.

MR. J. H. C. BROOKING explained that if trifurcating boxes were fitted at the bottom of the pole in a sufficiently sheltered and suitable place and the right kind of insulated cable were used, there would be no need for sealing boxes. He also drew attention to the uses of his "Pernax" bird guards.

The PRESIDENT said he had used glass insulators for the last six or seven years and they had stood up very well, certainly far better than porcelain against stones. So far as salt was concerned, about two months ago on three miles of land running along the coast 14 porcelain insulators were damaged, but not one of the glass insulators went. His experience of glass insulators at 11,000 volts had been very satisfactory.

Cantor Lecture on Sound Reproduction

IN the second of the three lectures he is delivering at the Royal Society of Arts in London (see p. 529 of last week's issue) MR. A. G. D. WEST described various methods which have been used for recording sound on film, dealing in detail with the developments which accompanied the rise to popularity of the talking film, and showed how the two systems most commonly employed, namely, variable area and variable density, are handled in practice. He outlined the general requirements for successful recording and reproduction, explained the electrical and photographic processes employed by the various systems, comparing their advantages and disadvantages, including a brief comparison of disk and film recording, and then demonstrated by means of a talking film the manufacture of disk records as carried out in the GRAMOPHONE COMPANY'S factory. After demonstrating the action of needles in grooves by means of scale models 500 times their natural size, record wear, surface noise and possibilities of its reduction in the future, and flexible records were also touched on. Mr. West showed that, contrary to the generally popular idea that the mechanical gramophone would be superseded by the electrical reproducer, its day was by no means over and he finally gave a demonstration of an automatic machine of ingenious construction which is capable of playing and turning over records automatically in any prearranged order.

Electrical Development Activities in 1930

THE report of the BRITISH ELECTRICAL DEVELOPMENT ASSOCIATION for 1930, which was presented at the annual meeting on March 20th, shows that 37 additional supply undertakings were enrolled during the year, while 11 others increased their subscriptions. Owing to these factors and to a special subscription from the Electrical Contractors' Association the revenue rose from £30,974 to £36,867. The principal items in the expenditure were 45 per cent. in advertising towards the public, &c., 14 per cent. on the work of Area Committees, and 12 per cent. in salaries and wages. There are now nine Area Committees and the increased membership and revenue is largely attributable to the work of these committees and area officers. There are now seven special sub-committees dealing with specific matters; the latest one, that dealing with electric traction, has not yet met. The report reviews the work of these committees and it is noted that the Exhibition Advisory Committee participated in six exhibitions during the year. The Committee on Domestic Water Heating, &c., prepared a report reviewing the whole subject of domestic hot-water supply and suggesting appropriate lines of development. The Faraday Centenary Sub-Committee is actively considering plans for the September exhibition. Reference is made to the Refrigeration, "Outlet," and "Three Plug Points" Campaigns, and the Shop and Display Lighting Campaign conducted in conjunction with the Electric Lamp Makers' Association. The Association inserted 987 advertisements in national newspapers and journals and thus elicited 8,537 replies from interested readers. A total of 776 window displays were sold. Month by month a sales and publicity programme has been issued suggesting propaganda methods and offering the necessary materials. This has proved to be a valuable link between the national advertising and the local schemes of supply undertakings and contractors. During the year over 41,000 column inches of editorial matter dealing with electrical subjects appeared in British newspapers and journals. Special articles are now prepared and circulated to supply undertakings for use in the local Press. Mr. G. S. Francis delivered 158 lectures to many kinds of audiences ranging in number from 20 to 500 and totalling about 12,000. A new film was prepared in connection with the Outlet Campaign and loans of this and other E.D.A. films totalled 137. For five weeks, the Association, in co-operation with E.L.M.A., ran an electric home exhibit at Charing Cross Underground station which attracted 144,000 visitors. In February last year a four-day course of instruction for women demonstrators was held at the Lighting Service Bureau; 130 persons attended. There were also a two-day conference of supply undertaking sales and publicity managers in April; a two-day course of lectures arranged by the Industrial Electric Heating Sub-Committee; a conference at the Royal Agricultural Show on electricity in farming; and the usual salesmanship conferences. The Association assisted the Electrical Association for Women in organising the Board of Education Summer School for Teachers of Domestic Science in August last. Mention is made of Association meetings at which E.D.A. was represented and of the bodies with which it is co-operating. A substantial part of the report is devoted to the activities of the E.A.W. during the year, which have been many and varied. After reference to the E.D.A. publicity service, Lt.-Col. Vignoles's visit to the United States, and the appointment of Mr. Cramb as director and secretary, the report concludes with the following words: "The Council think that there is an immense scope for educational propaganda work such as is carried out by the Association, propaganda which is devoted to selling the electrical idea and not to the selling of any particular brand of apparatus. This report shows the great range of the work carried out by the Association; more could be done, but only if additional funds were available."

Luncheon.—Over 500 attended the luncheon at the Savoy Hotel—the largest number which has yet attended this annual function. The President of the Association (Alderman E. HUNTSMAN) was in the chair and the guest of honour was Sir William Bragg, F.R.S.

SIR WILLIAM BRAGG, proposing the toast of "British Electrical Industry," referred to this year's Faraday celebrations. He said that the exhibition which was to be held in connection with the celebrations should be made something more than an exhibition in the ordinary sense of the term. It must be one of the biggest lessons to the public upon the wonderful story of the development of the electrical industry. It must be a real lesson to the country and a real prospect of hope for the future. It must be not only a display to the public of the benefits of the use of electricity in its many forms, but of the manner in which Faraday's inventions were carried out and the individual effects of each one of them in founding enormous industries and adding to the amenities of the life of the people. It was proposed to arrange the exhibition at the Albert Hall in the form of a wheel, so to speak, with a display of Faraday's experiments in the centre and a series of steps running outwards, in the form of the spokes of the wheel, each leading to a display of the various industries of which the individual experiments had laid the foundation. The Post Office, the wireless industry, the cable makers, the power producers, manufacturers, and so on, had all generously contributed to enable something on these lines to be carried out. It was also hoped that there would be sufficient volunteers among those with knowledge of the various aspects, including students at the universities, who would take the trouble to learn how to explain it all and act as guides during the period of the exhibition in order to proclaim to the world at large what we in this country had done, what we were doing, and what we would do in the future. We must stop the tendency to an inferiority complex which showed itself at times and for that purpose it was essential to develop means of explana-

tion to the world, a task which the British Electrical Development Association had set out to do and was doing in an extremely efficient manner.

The PRESIDENT, responding to the toast, welcomed a number of guests from other countries and congratulated the Association on the fact that the president-elect for the coming year was Mr. Ll. B. Atkinson. Speaking of Lt.-Col. Vignoles, he said it was a tribute to the work he had done that this annual luncheon was the largest gathering that had yet been held by the Association. During the past year, he continued, the electrical industry had come somewhat into conflict with its gas friends because one Minister of the Crown had put himself in the position of advocate for the electrical industry, being a wise man and seeing things as they were and as they were likely to be. There was room for both, but if the gas industry insisted in regarding the development of electricity as an attack on gas, then the electrical industry would have to come out into the open and march forward to a victory which would be complete and final. He claimed that everybody would agree with the Council's choice of Mr. Cramb as successor to Col. Vignoles. Having regard to the work which Mr. Cramb had done for the I.M.E.A., they all had the utmost confidence that he would do similarly good work for E.D.A.

DR. N. A. HALBERTSMA spoke of the remarkable progress being made in electrical matters in Great Britain, particularly with regard to lighting. He said that the British Electrical Development Association was recognised as first among all similar organisations in Europe.

Meeting.—ALDERMAN HUNTSMAN presided at the annual meeting when the annual report of the Council and the accounts were carried without discussion. After the nominations from the founder associations to membership of the Council had been approved, MR. R. W. L. PHILLIPS moved the election of Mr. Ll. B. Atkinson as president for the coming year. MR. R. P. SLOAN seconded and the nomination was adopted with acclamation.

MR. ATKINSON then took the chair, and in the course of a few remarks said he had always felt that the easiest way to get business on the manufacturing side of the industry was to try and educate the public in the uses of electricity. In the early days, the Association was carried mainly on the backs of the manufacturers, but gradually the supply industry had seen how its interests were interwoven and the result was that they were now supporting the Association to a very much larger extent.

On the motion of MR. S. E. BRITTON, seconded by MR. H. F. SIMON, the meeting unanimously elected Alderman H. K. BEALE as vice-president. The meeting concluded with votes of thanks to all who had worked for the Association during the past year.

Royal Institution Lectures on the Art of Illumination

ILLUSTRATED with lantern slides and modern examples of fittings, the series of three lectures delivered by MR. J. W. T. WALSH, M.A., D.Sc., M.I.E.E., before the ROYAL INSTITUTION in London emphasised that within comparatively recent years sources of artificial light have been so improved that a new branch of applied art has been born. In fact the art of illumination is so very new that it is only just beginning to receive recognition outside the circle of those intimately associated with its developments.

A historical account of lamps of all kinds preceded construction details, which explained that a drawn-wire tungsten-filament vacuum lamp's efficiency is about 8 or 9 lumens per watt. As its temperature is raised the metal evaporates quickly, so shortening its life, but the rate of evaporation can be greatly diminished by filling the bulb with inert gases at a pressure of rather less than one atmosphere. Unfortunately, for all except very thick filaments, the cooling effect of the gas as it sweeps over the heated wire, due to the establishment of convection currents, takes away so much energy that the gain in efficiency due to the higher filament temperature is entirely lost, but by winding the filament into a very close spiral the convection losses are greatly reduced and a lamp of much higher efficiency is obtained.

A 200-watt 240-volt lamp has a filament 3 in. long made of tungsten wire 2¼ thousandths of an inch in diameter, coiled into a spiral of 780 turns with a pitch of 1/250 in. and a diameter of about 14/1000 in. The gas in the bulb is a mixture of nitrogen and argon in the ratio of 1 to 4 approximately, the gas pressure when the lamp is cold being about 5/7 of an atmosphere. The efficiency of such a lamp is about 13 lumens per watt, compared with about 9.5 lumens per watt for a vacuum lamp of similar rating, and increasing with size; for example, that of a 1,000-watt 240-volt lamp is about 17 lumens. Large varieties are now made, from the miner's 2-volt type to 3-, 5-, and 10-kW lamps of up to 20,000 c.p. or more for lighthouses and projecting flood-light on aerodromes. Modern arc lamp efficiency is comparable with that of a high c.p. tungsten-filament lamp.

Although the filament lamp has only just celebrated its jubilee, a serious rival has already appeared in the form of the luminous discharge lamp. The filament at the lower end heats a cylinder coated with a material having a high thermionic emission. The stream of electrons emitted from the cylinder travels towards the iron anode near the top of the bulb and so starts an arc in the gas, which fills the bulb at a low pressure of the order of 2 mm. of mercury. The arc forms the source of light and its colour is governed by the nature of the gas within the bulb. By means of a specially designed auxiliary circuit, such a lamp can be made to operate on an alternating-current circuit. The efficiency present approximates to that of the ordinary gasfilled tungsten filament lamp, but how it will develop remains to be seen. There is no doubt whatever that, quite apart from efficiency, the discharge tube has a very important future in front of it for many lighting purposes.

That modern lamps are highly efficient light-producing machines is unfortunately far from being the case. The best type of high-pressure gas lamp gives about 53,000 lumens per therm per hour; by far the greatest part of the energy produced is dissipated in the form of heat. If all that energy could be converted into white light, *i.e.*, if the emission could be entirely confined to the visible spectrum and be equally distributed throughout that spectral range, the light given per therm would be about 5,800,000 lumens, or over 100 times the amount now actually obtainable. Similarly, the most efficient filament lamp gives about 25 lumens per watt, or only about one-eighth of the 200 lumens per watt which could be obtained from a source giving an equi-energy spectrum within the limits of the visible range of wavelengths.

To-day illumination can rightfully claim its place among the useful arts and the modern designer of illumination systems must be as much an artist as an engineer.

Hitherto functionalism has inevitably been the guiding principle, but now some may think that the pendulum has swung too far to the opposite side and that we are in danger of almost sacrificing utility in the effort to produce effects which shall be pleasing to the eye. The design of fittings has been given a new orientation entirely; beauty of form, either intrinsic or in harmony with its surroundings, is the first requirement of a lighting fitting and for large installations the fittings are often specially designed to suit each individual case. Sometimes the fitting is not recognisable as such, but forms an integral part of the building in which it is used, and in many cases exceedingly fine results have been produced.

It is often considered that in a branch of applied art, such as the design of lighting fittings has now become, the form of the material (lamp bulb) should itself control the nature of the design to a very large extent. This is, perhaps, fortunate having regard to the almost certain advent of tubular gas-discharge lamps as a source of light, even for domestic purposes, in the very near future, and the lecturer suggested that the production of attractive fittings will in itself help forward this new development in the lighting art. What can be more attractive than a slender cylinder of light which can be bent into a vast variety of shapes and the colour of which can be selected with a view to decorative effect and harmony, or contrast, with its surroundings? It is not difficult to picture a ceiling fitting of red, blue, and yellow tubes of such relative lengths as to produce sensibly white light in the room.

Finally, the amount of attention that is now being devoted to artificial illumination has greatly stimulated interest in architectural provision for the admittance of daylight adequately into modern buildings. Not unnaturally the illuminating engineer can help considerably in this direction and he is proud of the fact that the scientific study of daylight has proceeded much further in this country than anywhere else in the world.

The South African Institute of Electrical Engineers

REVIEWING matters of current interest to the industry in his valedictory address as president of the SOUTH AFRICAN INSTITUTE OF ELECTRICAL ENGINEERS, MAJOR E. F. RENDELL pointed out that the commercial engineer served towards a valuable end in industry. The installation side, such as house wiring, was increasing in importance owing to recent progress in illumination in the domestic applications of electricity. The Institute, although interested in developments of that kind, was apt to regard the commercial side as unworthy of its interest, but the tendency to-day was for buildings to approximate in size to small towns, and electrical installations in such cases presented many important problems.

There were only six municipal electricity undrtakings in South Africa with a larger generating-plant capacity than that of the Fidelity Philadelphia Trust building in America, which had a total capacity of 5,700 kVA. It would be realised that such building-installation work was definitely an engineering problem that required special methods, which lifted so-called wiring out of the ordinary groove and rendered it worthy of more attention than it had received from technical bodies.

Major Rendell also described the system which had been evolved and and patented by the Victoria Falls and Transvaal Power Co., Ltd., for the automatic isolation of overhead extra-high-voltage lines.

Mr. A. M. Jacobs was elected president for 1931 and Mr. A. T. Rodwell vice-president.

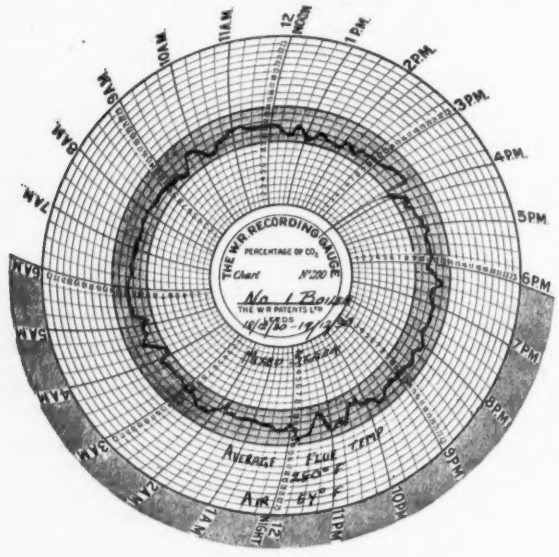
Combined Heating and Power Plant

Efficient operation, maintained with the aid of adequate metering facilities, enables an electric battery works installation to produce process steam and electrical energy at very competitive costs

By G. E. H. LEWIS

IT is lamentable that the term "industrial steam plant" is so often synonymous with waste and inefficiency, particularly in the case of small and medium-sized plant, in which too frequently the boiler-house staff is left to its own devices. The very dirtiness and inaccessibility of the plant suffice to preclude frequent visits by executive officers, who are apt to regard the boiler house and its surroundings as necessary but unattractive.

The value of efficient metering is too little realised and, since the losses are not actually visible, unlocated wastage continues. Apart from losses directly attributable to lay-out, or inefficient operation, a further serious waste which is frequently thought



Recording Gauge Chart

to be unavoidable is the exhaust loss from the prime mover, its magnitude being such as to merit serious thought.

As an instance of what may be done by efficient metering and the partial recovery of exhaust losses, the power plant at the works of the D.P. Battery Co., Ltd., of Bakewell, may be cited.

Boiler House.—The two Babcock & Wilcox W.I.F.-type water-tube boilers generate steam at 125 lb. per sq. in. pressure and 120 deg. F. superheat; a Galloway boiler of 80 lb. per sq. in. is now only used for heating purposes in holiday times when the rest of the plant is shut down. The two Babcock boilers, of 6,800 lb. per hour capacity each, are equipped with superheaters, chain-grate stokers, "Diamond" soot blowers, Green economisers, induced-draught fans, and (recently) Lea coal meters. The feed water consists of condensate from the turbine and the returns from various process and heating pipes. The small amount of make-up water is passed through a Lassen Hjort water-softening plant and enters the boilers at 1¼ deg. of hardness.

The duty of the boilers is to supply such prime movers as may be working, and any make-up high-pressure steam required. "Electroflo" meters are so installed that the total steaming rate in pounds per hour is always ascertainable, and the arrangements are such that the feed pump steam may either be included in, or excluded from, this total.

In passing it may be mentioned that the exhaust steam from the pumps is passed through a coil placed in the hot well, the temperature of which is thus raised from 65 to 120 deg. F. or more; the oily condensate runs away to a sump.

A Webster CO_2 recorder, continually analyses the flue gases and, since mixed slack is used, renders valuable information to the firemen. With such sources of information continually available the economical running of the boilers becomes a matter of routine. The feed water is tested for hardness and alkalinity frequently, and any necessary adjustments are carried out. The "Electroflo" meters are read every half-hour, and totalled at the end of each shift. The Lea coal meters are also read as each fireman comes on shift and the coal consumed is then calculated.

Each day the shift totals for the previous twenty-four hours are posted as shown in Table I. Each week the plant efficiency is worked out for record purposes, and the daily and weekly calculations also embrace turbine data. A typical boiler calculation is:—

Main steam, 764,150 lb. at $[1,258-(65-32)]=936,000,000$ B.th.u.
Live saturated to processes, 174,525 lb. at $[1,192-(65-32)]$
$=205,000,000$ B.th.u.

Pumps, 93,866 lb. at $[1,192-(65-32)]=108,500,000$ B.th.u.
Total steam, 1,032,541 lb.=1,249,500,000 B.th.u.
Total coal burned (Lea meter)=136,807 lb.
Calorific value=12,000 B.th.u. per lb.
Heat input=1,640,000,000 B.th.u.
Efficiency figure=76 per cent.
Lb. of steam per lb. of coal=7.55.

The above is an ordinary routine set of figures, such as is taken every week. The coal is subjected to frequent routine tests in the laboratory and checked by the ashes removed in each shift. With continually changing coal this feature is found to be invaluable, since it provides an immediate indication (in conjunction with the coal meters) of an excessive ash content. The ashes wheeled may be compared with the laboratory test and an excessive amount of unburned material going over the dumping bars is detected and checked at once.

The CO_2 recorder enables the flue losses to be calculated at any time by reference to the chart and the prevailing flue temperatures. A formula which has been found sufficiently reliable for the purpose is $L=0.35\ (\tau f-t)/CO_2$ per cent. in which L=percentage flue loss, τf=flue temperature in deg. F., and t=air temperature in deg. F. From the adjacent chart it can be seen that, taking the average CO_2 as 12 per cent. and

$$0.35\times(280-57)/12=6.5 \text{ per cent.}$$

Not the least valuable effect of such continuous metering is its physiological effect upon the operatives; while not suffering in any way from a sense of being watched, they realise that an interest is being taken in their job and, moreover, the instruments provide them with a tangible guide.

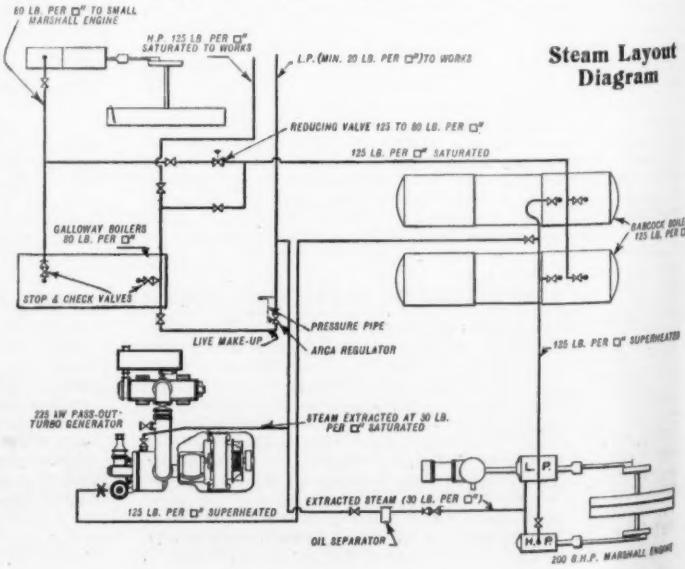
TABLE I.—SHIFT FIRING RESULTS.

Boiler No. 1. Date: 7.12.10.

Fireman's name.	Shift.	Total steam produced.	Boiler load.	Coal burned.	lb. steam per lb. coal.
No. 1	6-0/2-0	46,062	5,760	5,865	7.9
No. 2	2-0/10-0	47,272	5,900	5,950	7.96
No. 3	10-0/6-0	44,220	5,525	5,710	7.75

Remarks: ash content shift 6-0/2-0=7.6 per cent.; shift 2-0/10-0=7.5 per cent.; shift 10-0/6-0=9.8 per cent.

Pass-out Turbo-generator.—The steam demand for works processes amounts to about 2,000 lb. per hour at low pressure (a minimum of 20 lb. per sq. in.) and a smaller quantity of high-pressure saturated steam for heating ovens and working acid elevators. At times of all but the lowest loads the low-pressure steam is extracted from the 225-kW geared turbo-generator, which is the main works unit. It drives a G.E.C. 100-volt d.c. generator, was made by Messrs. Fraser and Chalmers, and is of their standard high-pressure impulse type, except that a pure impulse wheel replaces the usual velocity


60 LB. PER □" TO SMALL MARSHALL ENGINE
H.P. 125 LB. PER □" SATURATED TO WORKS
L.P. (MIN. 20 LB. PER □") TO WORKS
REDUCING VALVE 125 TO 80 LB. PER □"
125 LB. PER □" SATURATED
GALLOWAY BOILERS 80 LB. PER □"
BABCOCK BOILERS 125 LB. PER □"
STOP & CHECK VALVES
PRESSURE PIPE
LIVE MAKE-UP
ARCA REGULATOR
125 LB. PER □" SUPERHEATED
225 kW PASS-OUT TURBO GENERATOR
STEAM EXTRACTED AT 30 LB. PER □" SATURATED
L.P.
EXTRACTED STEAM (30 LB. PER □")
125 LB. PER □" SUPERHEATED
OIL SEPARATOR
H.P.
200 B.H.P. MARSHALL ENGINE

Steam Layout Diagram

stage after the first set of nozzles. Steam is bled from the first stage at a pressure of not less than 30 lb. per sq. in. at full load, and a check valve is provided in the pass-out main close to the turbine casing to isolate the machine during periods of extremely low load. An "Arca" regulator set to open at 20 lb. per sq. in. is installed in a small high-pressure pipe from the boilers, and is controlled by the pressure in the works low-pressure main. Should the load on the turbine drop to such an extent that the pressure in the pass-out main falls to below 20 lb. per sq. in. the regulator will open and admit sufficient live steam to maintain the set pressure.

In connection with this extremely sensitive device, a compensating effect takes place with regard to boiler load, and it is found that the live steam demanded for process work when the regulator opens nearly balances the steam equivalent of the lost electrical load. Owing to this condition the boiler load is not subject to severe fluctuations, a factor which, in itself, assists economy.

The whole of the condensate is returned to the hot well for feeding the boilers, whether the low-pressure steam is originally bled from the turbine or supplied through the "Arca" regulator.

As in the case of the boilers, the turbine is run under conditions of routine test. Half-hourly readings are taken at all the usual points, *i.e.*, steam pressures and temperatures, vacuum, circulating water, &c., and all oil pressures and temperatures. The "Electroflo" rate-of-flow meters mentioned earlier are situated in the turbine house and indicate "total steam to turbine," "bled steam," and "live steam to process." Their readings give the shift totals used in connection with the boiler-house calculations and the daily and weekly figures required for the turbine-house log. Typical weekly turbine-running figures are:—

Total steam	839,925 lb.
Bled steam	262,700 lb.
Process steam	144,150 lb.
Pumps	99,250 lb.
Electricity produced	21,181 kWh.
Average load	174 kW.
Steam per kW	19.7 lb.

Taking an evaporating factor of 7.55, the coal allocated to power becomes 2.61 lb. per kWh, which, at a price of 0.0725d. per lb.=0.189d. per kWh.

Under ordinary running conditions with normal superheats, reckoning the expansion through the first stage of the turbine to be adiabatic, the quality of the bled steam at the turbine casing is slightly superheated (calorimeter tests have, in fact, proved this to be the case). For all practical purposes, however, this steam is taken as dry saturated at its point of utility. Thermally the figures are as follows for a set of normal readings:—

Load=211 kW.
Main steam at throttle=129 lb. per sq. in.
Temperature=435 deg. F.
Bled steam=30 lb. per sq. in. saturated.
Main steam=5,650 lb. per hour.
Bled steam=2,050 lb. per hour.
Heat input=5,650×1,238=7,000,000 B.th.u.
Converted to kW=211×3,415=720,000 B.th.u.
To heating main=2,050×[1,171−(60-32)]=2,347,000 B.th.u.
Heat usefully employed=3,067,000 B.th.u.
Lost in circulating water, radiation, condensate, &c. =3,933,000 B.th.u.
Thermal efficiency from stop valve=44 per cent.

Stand-by Plant.—This consists of a 200-b.h.p. Marshall cross-compound engine driving a 100-volt d.c. generator made by the Lancashire Dynamo & Motor Company. This was originally the main plant, but since the installation of the turbine it is only used in case of emergency. Provision is made for extracting steam from the engine through a receiver placed between the high- and low-pressure cylinders. The amount of steam which can be used in this way is controllable within certain limits by an adjustable cut-off on the l.p. cylinder. The steam taken by the engine is not metered, but indicator cards have been taken at all loads and under both extracting and non-extracting conditions. By reference to the cards and the use of a well-known formula, the Willans line has been plotted. The formula is $W=2(v\times m/s+c)u$, where W=the weight of steam per complete stroke; v=effective volume swept by piston; m=length of stroke measured to cut off on diagram in convenient units; s= stroke in units on diagram; c=clearance in units from diagram; and u=weight of steam per cubic foot at inlet pressure. The above has been found to give very close results, at all events with the particular engine in question, as the Proell valve gear gives a well-defined cut off on the indicator card. A fairly large-scale Willans line, derived as shown, enables direct steam consumption readings to be taken for any given conditions of load. Thus, whichever set of plant is running, detailed performance figures are available.

Water-power.—Roughly one-fifth of the power demand is supplied by two water wheels whose period of usefulness still continues after more than one hundred years. Acting as an auxiliary to them is a single-cylinder 120-h.p. Marshall engine, which is used during periods of low water, when it operates through a clutch. It was originally driven by the Galloway boiler at 80 lb. per sq. in., but a steam main has now been run over from the saturated-steam side of the Babcock boilers and an "Auld" valve is employed to reduce the pressure from 120 to 80 lb. per sq. in. for the engine. The steam consumed is indicated by a meter and the lower diagram on the previous page shows the general simplicity and workability of the lay-out.

Control Room.—The meters, indicators, gauges, &c., are installed in the turbine house, which constitutes a convenient central control room from which the plant is continually under observation. From the platform the conditions governing the whole plant at any moment can be read off, and the grouping is such that a coherent story is told. An abnormality in any unit can be instantly detected, and incipient faults noted and remedied long before a serious stage is reached.

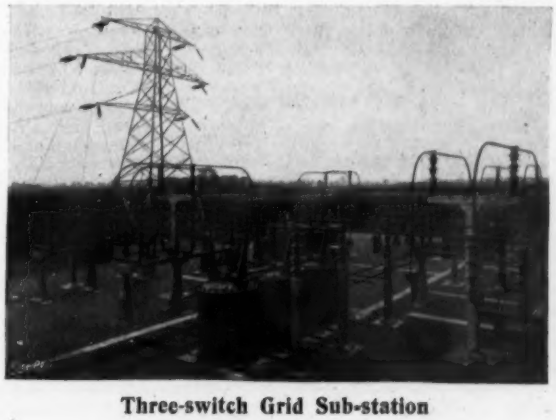
Records.—The keeping of records in itself is of value, and by reference to past entries it is possible, without a great deal of elaboration, to decide with certainty the necessity of opening up any part of the plant. This is especially helpful in the case of the surface condensers, in which fouling of the cooling surfaces takes place very gradually and can easily remain unnoticed until attention is demanded by actual loss of vacuum. Reference to the daily log indicates the approach of the time when the loss due to dirty surfaces offsets the cost of cleaning. Many other instances could be cited of savings directly attributable to the keeping of records and the intelligent interpretation of meter-readings. The fact that an effective arrangement "makes losses visible" ensures certainty and economy of control which would be impossible under archaic rule-of-thumb methods.

Cost.—One point elucidated by the above installation is the fact that where process steam or heating is required, a comparatively small steam plant can supply electricity at an all-in working cost of 0.37d. per kWh, including labour and lubrication costs, which is far less than the charge for energy purchased from the national grid or any public supply station.

Little Barford 132,000-volt Sub-station

LITTLE Barford transforming station was the first in England to give a public supply from the 132,000-volt grid. This station is connected by a 132,000-volt feeder to Bedford transforming station, which was the first in England to be made alive at that pressure. This was done on May 23rd, 1930, and five days later Bedford was interconnected with Luton at 132,000 volts, each station acting as a stand-by to the other, although, actually, it was not found necessary to transmit load in either direction until August. It was on September 8th, 1930, that the Little Barford station and the line from Bedford to Little Barford were made alive at 132,000 volts, and the supply to the Bedfordshire, Cambridgeshire and Huntingdonshire Electricity Company was transferred to this sub-station. For some 18 months previous to this the line between Bedford and Little Barford had been in temporary use at 33,000 volts for giving this supply direct from Bedford and was the first of the Board's lines in any area to be put into commercial service.

The station is of the low non-extensible type, and the general view reproduced here shows the main anchoring tower for the two 132,000-volt feeder lines. It is a three-switch station, one of the circuit-breakers being used for bus-bar sectionalising, and the other two to control feeder circuits, or, alternatively, transformer circuits. The circuit-breakers, which are designed to carry 600 amperes, are solenoid-operated and, like those in the Bedford and Luton stations, are of Messrs. A. Reyrolle and Company's manufacture. The two Ferranti transformers are of 20,000-kVA capacity. The air-break isolating switches, which are mounted on concrete pillars, are ganged into three-phase units. The control house is immediately adjacent to the switchgear.



Three-switch Grid Sub-station

Norwich Rural Electrification

The Second Demonstration Scheme is Expected to be Self-supporting After Three Years

FOLLOWING the initiation of the Bedford Demonstration Scheme in 1929*, the Electricity Commissioners were asked by the Minister of Transport to arrange similar schemes for intensive electrification in other typical rural areas. The present scheme, a description of which was issued last week (H.M. Stationery Office, 6d.), and a forecast of which was given in the ELECTRICAL REVIEW of August 22nd and 29th, 1930, covers 125 sq. miles (shown in the accompanying map) in the area of Norwich Corporation by whom it will be carried out, subject to the general oversight of the Electricity Commissioners. The selected area has a population of 14,166 (1921 Census), averaging 113 per sq. mile, as compared with 151 for all rural areas in England and Wales, and includes 49 parishes and 3,588 occupied dwellings. The area is dependent almost wholly on agriculture; 95 per cent. of the land is cultivated, mostly arable, with a small proportion of pasture. There is no public supply of gas. Supply will be given from Norwich by an 11,000-volt ring main, which also serves eight other rural districts. The network will consist of 60 miles of 3-phase and 40 miles of single-phase overhead lines at 11,000 volts. Three-phase transformers have been standardised at 35, 50, and 100 kVA, and single-phase at 10 and 20 kVA. Low-voltage distribution will require 40 miles of lines at 400 and 230 volts. A start has already been made and the whole of the system is to be constructed by December, 1932, at an estimated cost, including services and meters, of £60,000. By the end of six years the annual consumption per head is conservatively estimated to reach 100 kWh, or 500 per consumer, yielding a revenue of £5 per consumer based upon the Corporation's two-part tariff, which includes a secondary charge of 1d. per kWh. The number of connections then anticipated will be 2,800, yielding a total gross annual revenue of £14,000. The capital sum of £60,000 does not include any allowance for assisted-wiring or for apparatus on hire or hire-purchase, as the facilities now offered by the Corporation in other parts of its area of supply will be extended to the demonstration area.

The experience of the Corporation has been that with assisted-wiring most householders will use electricity for lighting as soon as it is available, but that its utility for other purposes requires to be brought to the attention of consumers by demonstration and propaganda, such as by means of the travelling van recently acquired by the Corporation.

The cost of the bulk supply to the area will be 1.18d. per kWh at the outset, decreasing to 0.7d. in the sixth year. After providing for interest on bank overdraft, deficits are anticipated for three years. In the seventh year of operation accumulated surpluses are expected to wipe out the earlier deficits.

As Norwich Corporation is carrying out the work in advance of normal development and at a loss for some years, the Minister of Labour, on the advice of the Unemployment Grants Committee, will make a grant to the Corporation under the Development (Loan Gurantees and Grants) Act, 1929, of 50 per cent. of the interest for 15 years on £41,000, the amount eligible under the conditions.

Norwich Supply Area

* ELECTRICAL REVIEW, February 28th, 1930.

Book Reviews

Magnetic Phenomena. By S. R. WILLIAMS, Ph.D., D.Sc. An Elementary Treatise. Pp. xxii+230; figs. 150. London: McGraw-Hill Publishing Co., Ltd. Price, 15s.

The author outlines, in his introductory chapter, the outstanding problems of the science of magnetism and the nature of the research work called for. Among these problems are the improvement of all forms of instruments for magnetic measurements and the correlation of various magnetic phenomena by data obtained from the same specimens. There is also an urgent call for repetition of a good deal of work already carried out by early investigators, using modern improved methods and apparatus, and also for co-operative work by groups of physicists, mineralogists, chemists, metallurgists, and X-ray experts. A further urgent need is for adequate summaries and digests of the extensive and scattered literature dealing with past experimental work. Dr. Williams considers that the result of extensive work in the field of magnetism on the lines he has suggested would have far-reaching results: on the practical side by the development of methods of analysis which would be of great service in the industrial arts, and in the advancement of pure knowledge by shedding considerable light on the problem of the structure of the atom.

The author treats his subject under the five heads of magneto-mechanics, magneto-acoustics, magneto-electrics, magneto-thermics, magneto-optics, and adds chapters dealing with terrestrial magnetism and with magnetic theories and experimental facts. A fair proportion of the subject matter of the book is included in the standard works on physics, and electricity and magnetism. In such works, however, the subject of magnetism occupies but a subsidiary place, and Dr. William's book contains accounts of magnetic phenomena, and lucid accounts of the theory of the same, which are not readily accessible to the student. The title of the book correctly indicates its scope in that it is confined to a discussion of magnetic phenomena, rather than to a study of the properties of magnetic materials; it is for this reason, therefore, that the remarkable magnetic alloys, which have recently enabled so revolutionary an advance to be made in the technique of electrical measurements, receive but a passing mention. It is interesting to note that the author considers permeability to be a mere ratio of zero dimensions. It is well known to students of physical science that this conception leads to a difference in the dimensional formulæ of electrical quantities calculated from the fundamental equations of electro-statics and electro-magnetism For this reason it is to be regretted that Dr. Williams was content with a mere statement of opinion on so interesting a point.

The book has been well written and produced. The illustrations are excellent and there are two good indexes, the one referring to names and the other to subjects. A moderate knowledge of mathematics, which includes the elements of the calculus, suffices for an intelligent reading. The work can be recommended to advanced students without reserve, while it will be a most desirable and valuable work of reference for the engineer and scientist.

The Electric Organ. By REGINALD WHITWORTH. Pp. 202; figs. 92. London: *Musical Opinion*. Price, 15s. 6d. net.

Both the beginner and the student who is more advanced in the art of electric organ construction will welcome this book. Although the subject is a ponderous one, the author's treatment of it is never so. Mr. Whitworth is an able technician, who at the same time has had a good grounding in the generalities of his subject. He writes with interest, and so transforms into an entertaining volume matter which, dealt with by a less masterly hand, might have been "dull as ditch-water." Of constructional detail he exhibits intimate knowledge; historically, too, his intimacy with his subject is manifest.

From the first chapter, which briefly describes in easy language the components and general interior arrangement of the modern organ, the book proceeds by chapter stages to generally describe the technicalities of the electric system. A chapter is devoted to "The Electric Organ in the Residence and Cinema," and after enumerating and describing "Some notable electric organs," the author draws towards his conclusion by remarking on the necessity for the use of the highest quality materials in organ building, and he makes the pertinent point that "Modern cables are expensive, but all contingencies are provided for!" The volume contains eight plates on art paper, ninety-two figures—which illustrate the *working principle* of the mechanism described rather than the individual piece of action work itself—and a large number of specifications of organs electrically operated. It is a comprehensive treatise of the modern application of electricity to the construction of the "king of instruments," and as such, it deserves to become a "best seller" of its class.

We have one severe criticism to make, which we hope will bear fruit should the book run into a second edition: Why, to such a monumental work, did not Mr. Whitworth append a glossary?

Parliamentary Notes

[By our Special Parliamentary Reporter]

Cables and Aircraft

On March 17th, during a debate on the air estimates, MR. MATTERS called attention to the dangers to which airmen were exposed from high-power electric cables. He believed that it would be relatively simple for the Electricity Commissioners, in laying out their grid schemes, to avoid those sites which had been ear-marked for civil aviation, and so avoid later on all the difficulty and trouble which arose when these high-power electric cables blocked the approaches to an aerodrome.

MR. MONTAGUE, Under-Secretary for Air, in reply, said that during the year the Air Ministry had issued circular letters calling the attention of municipalities to the danger to aircraft from overhead cables near aerodromes. He stressed the fact that the Air Ministry was working in close liaison with the Electricity Commissioners.

Mr. Morrison and His Critics

On March 18th BRIG. GEN. CLIFTON BROWN asked the Minister of Transport whether he had considered the protests sent to him from municipal and other gas undertakings, protesting against his action in recommending electricity at the expense of gas companies, and whether he would receive deputations on the subject.

MR. MORRISON said the conferences which he had recently held with representatives of electricity supply undertakings were arranged with a view to urging them to provide additional employment by expediting their development, and he pointed out that the continued development of the two industries had not proved incompatible. He had not been approached directly on the subject by municipal or other gas undertakers.

BRIG. GEN. CLIFTON BROWN asked whether the Minister would be willing to receive any deputations on the subject.

MR. MORRISON said that when applications for deputations were made he would consider them, but he was not yet convinced that he had committed any offence.

SIR K. WOOD asked if the Minister had seen the letter of protest, signed by members of his own party, appearing in a Scottish paper that day.

MR. MORRISON said he had seen letters of protest from the gas industry, but he was perfectly certain they were drafted and signed under a complete misapprehension of the facts.

" Pylons " in Yorkshire

On March 18th MR. TURTON asked the Minister of Transport whether he would again consider the proposed line of pylons between Pickering and Whitby; and, since this line across the moors would be a menace to the beauty of the scenery, whether he would recommend the alteration of the proposed line so as to pass through the coastal villages.

MR. MORRISON said he understood that this matter had been discussed with the local authorities concerned, but no formal application for his consent had yet been made. The Central Electricity Board found it necessary to divert the route of the principal grid lines in this part of the country from close proximity to the sea, in order to obviate the risk of interference with supply due to the salt-laden atmosphere.

The Staines Company

On March 18th MR. EDE asked the Minister of Transport whether his attention had been called to the terms upon which the share capital of the Egham and Staines Electricity Supply Co. had been acquired by the Metropolitan Electric Supply Co.; whether such terms represented an appreciation of over 100 per cent. of the nominal capital of the Egham and Staines Electricity Supply Co.; and whether he proposed to take any steps to ensure that the burden of increased capitalisation should not fall upon the consumers of electricity in the area of either of the companies concerned.

MR. MORRISON said that according to the chairman of the Metropolitan Co. the Egham and Staines shareholders were to receive one ordinary share of the Metropolitan Co. for each ordinary share held by them. As the exchange was thus made on a " share for share " basis the latter part of the question did not arise.

Main-line Railway Electrification

On March 18th MR. ALBERY asked the Minister of Transport if he could say when the report of the Committee on Main-Line Railway Electrification was likely to be issued.

MR. MORRISON said that he understood that he would probably receive the report shortly

The London Transport Bill

On March 23rd, MR. MORRISON, the Minister of Transport, moved the second reading of the London Passenger Transport Bill, which proposes to set up a board of five persons to co-ordinate all the passenger traffic undertakings in the London Traffic Area. Mr. Morrison said he had come to the conclusion that the proper body to set up was a business board. He had been influenced by the example of the last Government in setting up the Central Electricity Board in 1926. The Board was not a political body: it was a business body, but there was an element of public accountability, public service, and public spirit. He desired to obtain the best brains possible, and certainly the chairman must have great industrial and managerial ability, and they must be prepared to pay what was necessary in order to secure that ability, if the undertaking was to be efficient. The powers to be vested in the board were to be exercised so as to secure an adequate and properly co-ordinated system of passenger transport in the London Traffic Area with a number of certain incidental provisions.

The rejection of the Bill was moved on behalf of the Conservative Party by SIR P. CUNLIFFE-LISTER, in the following terms:—" That this House, whilst again willing to consider any sound scheme for the co-ordination of London traffic, declines to give a second reading to a Bill which provides for the nationalisation of London passenger transport; deprives local authorities of control in respect of their various undertakings; takes the property of private owners out of their control; gives them no option of sale; vests in the Minister of Transport bureaucratic powers; and constitutes him, and not a judicial tribunal, the court of appeal in such important matters as the provision or withdrawal of traffic services and facilities."

After a lengthy debate, the amendment was negatived by 271 votes to 224—Government majority 47—and the Bill was read a second time and committed to a committee of both Houses.

Post Office Estimates

On March 19th, during the discussion on the Post Office estimates, MR. ATTLEE, the Postmaster-General, replying to criticisms, said he was in favour of a more rapid development of the telephone service. In point of fact in 1930 our increase in telephones was ten times as rapid as that of the United States. The growth of the telephone in rural areas was even greater than in urban areas. In the last 18 months, 4,200 rural call offices had been opened. Wireless licences at present numbered 3,590,000, an increase of 263,000 in the last three months.

Legal

Claim for Overdrawn Commission

IN the King's Bench Division last week, Mr. Justice Rowlatt had before him an action by Messrs. Frederick Thomas & Co., Ltd., designers and manufacturers of electrical fittings, Hampstead, against Mr. Henry Evans, Harrow, to recover the sum of £140 commission alleged to have been overdrawn by the defendant between August, 1926, and January, 1929.

The case for the plaintiffs was that the defendant applied for the position of sales manager, stating that he could bring at least £5,000 worth of extra business a year. It was agreed to give defendant £6 a week and a commission of 2 per cent. on all sales over £15,000 a year. The defendant being confident that he could do the extra trade, the plaintiffs said they allowed him to draw commission at the rate of £2 a week. Plaintiffs' case was that it was made clear to the defendant that the commission money was a loan and was to be repaid if he did not earn the commission. The plaintiffs said that the defendant did not increase their turnover at all, and ultimately sent in his resignation.

The defence was that it was agreed that the defendant should have £8 a week, being £6 a week salary and £2 commission. This commission was not to be repaid, and the plaintiffs had said they would send out a traveller and make the increase of turnover needed. They sent out a traveller for a short period only. The defendant set up a counterclaim under this head for alleged breach of contract.

His LORDSHIP gave judgment for the plaintiffs with costs.

Light-o'-Day Electric Lamp Co. (1927), Ltd.

IN the Companies Winding Up Court on Monday last Mr. Justice Maugham had before him a petition by Messrs. Ruscoe Bros. & Co,, for the compulsory winding-up of the Light-o'-Day Electric Lamp Co. (1927), Ltd. The petitioners were judgment creditors for £108 and £11 costs, and there was no opposition.

His Lordship made the necessary order.

On Wednesday Mr. Copping applied on behalf of the company for a stay of the order. He said that the total liabilities were £1,600 while the company expected to be in funds to the extent of £3,000. His Lordship granted a week's stay.

Jib Crane Regulations

The Home Office has issued draft regulations for jib cranes in factories and other premises, the use of which is desired to be certified under Section 79 of the Factory and Workshops Act, 1901, as " dangerous." Under the new draft regulations, which have been submitted to the parties concerned, jib cranes must be properly tested and examined at regular intervals, and a certificate of such test, specifying the safe working load, or loads, must be obtained. In no case, except for testing purposes, must cranes be loaded beyond their safe working loads and a further and important requirement is the provision of an automatic indicator to show when such limits are approached and exceeded. Provisions are also included with regard to secure anchorage, the condition of the rail track in the case of travelling jib cranes, and other important factors affecting safety.

Correspondence

Correspondents should forward their communications as early as possible. No letter can be published unless we have the writer's name and address in our possession

Motor Impregnation

Referring to the letter published in the correspondence columns of your issue of March 6th under the above heading, it may have seemed surprising to many of your readers that there *could* be two opinions as to the value of impregnating the windings of electric motors used in colliery work.

That two opinions exist is certainly the best proof possible that many so-called impregnated windings are not really impregnated at all, but have simply been dipped in varnish, receiving a surface coating only, or, in some cases, the varnish may even have penetrated slightly below the surface, thus effectively preventing the moisture in the inner turns from being expelled when the motor heats up. Motors whose windings have been so treated may, of course, pass severe tests on the manufacturer's test bed, as it is only after a considerable time that the entrapped moisture will accomplish its deadly work. Sooner or later, however, verdigris, or "greening," will appear, destroying the cotton covering of the wire, and there will be a breakdown. Strange to relate, there are still some engineers who regard this state of affairs as "quite normal" and to be expected in the ordinary course of events.

Mr. Harvey will find information on this subject in the article entitled "Insulation Impregnation," which I contributed to the ELECTRICAL REVIEW on February 17th, 1928. In the correspondence which followed the publication of the above article, the complaint was made that only the views of the manufacturers of impregnating plant or of electrical machinery had been expressed; I would, therefore, like to give the results of my own personal experience in the matter.

Some years ago I was in charge of the electrical plant of a large Continental iron and steel works where over 1,000 d.c. and a.c. electric motors were installed. These works ran night and day, 7 days a week, and anyone who knows anything about the conditions prevailing in an iron and steel works will appreciate how essential it is to avoid the breakdown of the electrical equipment; for instance, should a motor fail on an important overhead crane, the disorganisation produced is astounding until the crane is put to work again. How extraordinary it is that these motors always seem to break down at night!

To cut a long story short, I was obliged, in order to avoid being called out of bed in the middle of the night to attend to breakdowns, to have all the motors on a certain crane stripped, re-wound, and properly impregnated in an *up-to-date* vacuum pressure impregnating plant. Further, I made it a rule that no more motors should be purchased except from firms so equipped as to be able to supply properly impregnated motors

I may say that the motors in question on this crane were manufactured by a well-known firm, and their windings had quite evidently only been "hot dipped." My own personal experience of motors whose windings have been "hot dipped" has led me to the conclusion that they are to be avoided like the plague if reliability is required. The description I have heard given to the buildings of the capital of a certain South American Republic can be aptly applied to them: they are Queen Anne "outside," but Mary Anne "inside."

London, S.W.1, *March 16th*, 1931. A. C. DUNLAP.

With reference to Mr. A. Harvey's letter under the above heading in your issue of March 6th, I would suggest that a machine, before repair or rewind with enamelled wire, should be placed in an oven for 36 hours at a temperature of 180 deg. F. This will tend to remove all air pockets that exist in the new windings and also all moisture, which the enamelling before baking would to a certain extent get rid of. Then remove and apply a coat of enamel that is hot-oil proof, flexible and of excellent penetration. By far the best means of applying the enamel is by means of a sprayer and compressed air; this should be done whilst the machine is hot. Then replace in the oven for 6 to 12 hours at the same heat, after which the machine should be removed and a final coat of finishing varnish applied. The insulation upon all evolutes should be continued up flush with the core and should not finish level with the slot linings as it sometimes does. The latter method allows all foreign bodies, such as oil and dirt, to get between the conductors and so cause breakdowns.

Northfleet, *March 21st*, 1931. E. W. O'COY.

The Life of Electric Lamps

The statement is frequently made that "Pearl" lamps have not the same length of life as clear ones. My own experience of "Pearls" has certainly been unsatisfactory, but one does not wish to generalise on small experience.

Perhaps some other readers would say what their experience has been. The "Pearl" lamp has many advantages, but one would like to feel sure that it will be satisfactory before standardising it.

North Shields, *March 16th*, 1931. C. TURNBULL.

Cost of Electricity in the Country

"Villager" puts my case exactly. He accuses me of irrelevance in comparing the reasonable Hackney prices with the exorbitant prices charged in Burnham. Then why supply all the way from Barking? A modern local plant, without too elaborate safeguards (none of which the company is providing) and without the cheap and ugly overhead network which the company has installed, could give a cheaper supply. That was my contention, *viz.*, that the grid scheme is not in fact giving us the cheap and abundant supply which was promised.

Surely the Commissioners will have to look into such matters as these and decide whether these high prices in the country are due to an economic defect in their schemes, or to profiteering on the part of the companies. L. L. ROBINSON.

Burnham-on-Crouch, *March 20th*, 1931.

Engineering Degrees

With reference to the recent correspondence in your columns on the value of engineering degrees and diplomas, I should be pleased to learn of anyone in service with a municipal supply authority who has derived any real benefit from passing the examination for Graduate Membership of the I.E.E. Previous to passing this examination, my wage (not salary) was about £3 per week—it is still £3 per week.

Promotion seems to be governed either by internal influence or by the "theatre-queue" system—both of which are independent of merit. I suggest to others in municipal employment who are contemplating taking this examination that the entrance fees, cost of text books, &c., would pay for a new suit, which, if the pattern happened to please the eyes of their superiors, might stand them in better stead than a successful examination result.

March 23rd, 1931. ANOTHER GRADUATE I.E.E.

Belgian Battery Omnibuses

Introduced on the occasion of the opening of the International Exhibition at Liége, four electric battery-driven omnibuses built by the Société Belge de Traction Electrique par Accumulateurs, of Brussels, are now in daily service in the former city, says *Modern Transport*. They incorporate several innovations; for example, the chassis is in two portions, a "false" one supporting the battery boxes and coachwork. Each rear wheel is driven by an electric motor which is connected by two cardan joints of the Glaenzer type. A contactor-type controller is provided with one rheostatic and two mechanical brakes, one of the latter acting on the motors and intended for use when the vehicle is stationary. The front wheels are shod with single and the rear ones with twin pneumatic tires for a total load of 13 tons. The exterior of the single-deck body is built up of aluminium; 32 seats are provided and 18 passengers can stand on the rear platform, the entrance being at the front and the exit at the rear, both doors on the same side. The electrical equipment was constructed by Ateliers de Constructions Electriques, of Charleroi. Each of the two motors is rated at 24 h.p., 160 volts, 900 r.p.m., at the one-hour rate. The battery is grouped in four containers, each capable of holding either 21 lead cells or 36 ferro-nickel cells, of a capacity of from 300 to 400 ampere-hours. The containers are movable and can be emptied of the cells in a few minutes with the aid of a small hand, or electric, mobile crane. The weight of the containers varies between 12 cwt. 2 qr. and 15 cwt. 3 qr., according to the type of battery, those used in the "Ville de Liége" omnibuses being of the Edison type. With normal conditions of load and traffic, that is to say, for a total weight of about 12 tons (calculated for 50 passengers), the radius on a good level road would be about 50 miles, the speed varying from 5 to 23 miles per hour. Under service conditions the vehicles have a maximum speed of 21¼ m.p.h., maintained an average speed of 13¼ m.p.h., are easy to handle, and have good acceleration.

"Side Lines" of the Cable Maker

The cable maker is naturally visualised as being principally engaged in the manufacture of standard types of power, light, and telephone cables. It is not perhaps so generally realised that he is also called upon to supply many subsidiary types of conductors and accessories for varied purposes. Amongst "side lines" of this description recently made by British Insulated Cables, Ltd., of Prescot, are laminated copper strip, braided aerial cables, pure tin strip for internal connections of static condensers, enamelled-aluminium wire, lead piping for organs, paper-insulated flat twin lead-covered house wire, steel-cored segmental aluminium conductors, stub-end cables for telephone cable loading coils, bitumen-compounded cotton cord, aluminium-alloy rod for knitting needles, lead piping in spiral coils, lead-covered spiral springs, spirally wound mild-steel sealing wire, and extruded aluminium tubing reinforced with a steel wire core.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1929

3,196. "Electrically-operated musical instruments." S. Prisner. November 30th, 1929. (343,985.)

25,212. "Receiving and amplifying arrangement, especially for apparatus with high-frequency amplification." M. Von Ardenne. August 19th, 1929. (343,903.)

25,309. "Valve amplifiers for wireless reception and the like." M. Von Ardenne. August 22nd, 1928. (317,793.)

25,526. "High-frequency thermionic valve amplifier." M. Von Ardenne. August 23rd, 1928. (317,828.)

28,698. "Method and arrangement for synchronising kinematograph films with sounds transmitted by wire or wireless." C. R. Blum. September 21st, 1929. (343,990.)

29,257. "Resistance-coupled thermionic amplifier." Loewe-Radio Ges. and Dr. O. Emersleben. September 28th, 1928. (319,782.)

32,037. "Electric driving sets." Electric Construction Co., Ltd., W. Tonkinson, and M. S. Dick. October 22nd, 1929. (343,904.)

32,044. "Electric radiator fires." Ferranti, Ltd., and G. R. Z. de Ferranti (legal representative of S. Z. de Ferranti, deceased). October 22nd, 1929. (343,905.)

32,430. "Electrical circuit breakers." General Electric Co., Ltd., and A. F. Cornock. October 25th, 1929. (343,907.)

32,719. "Electro-therapeutic hair brushes." D. Simpson. October 28th, 1929. (343,995.)

33,296. "Thermionic audion amplifiers." Radio Frequency Laboratories, Inc. October 3rd, 1929. (343,999.)

33,316. "Radio receiving sets." J. J. Mettes, Jun. November 1st, 1929. (Addition to 341,442.) (344,000.)

33,396. "Relays." G. F. Shotter and F. R Butherus. November 2nd, 1929. (344,001.)

33,635. "Method and means for improved voltage regulation in an intermittently closed circuit." Standard Telephones and Cables, Ltd. (Western Electric Co., Inc.). November 5th, 1929. (343,998.)

34,431. "Magnets." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. November 13th, 1928. (343,908.)

34,697. "Timing devices." J. F. Grimbley and Telephone Manufacturing Co. (1929), Ltd. November 13th, 1929. (343,951.)

34,731. "Combined sound and picture records and containers therefor." Western Electric Co., Ltd. (Bell Telephone Laboratories, Inc.). November 13th, 1929. (343,883.)

35,023. "Electrical supervisory systems such as fire and burglar systems and the like." W. Kidde & Co., Inc., and H. C. Grant, Jun. November 15th, 1929. (343,972.)

35,370. "Arrangement for transmitting communicating currents with discharge tubes." Siemens & Halske Akt. Ges. November 20th, 1928. (Patent of addition not granted.) (343,914.)

35,519. "Sound-reproducing apparatus." Siemens & Halske Akt. Ges. November 26th, 1928. (343,893.)

35,767. "Circuits controlled by light-sensitive cells." W. Engelke and H. L. Read. November 22nd. 1929. (343,960.)

35,835. "Indicating systems." British Thomson-Houston Co., Ltd. November 22nd, 1928. (344,008.)

35,977. "Cord circuit repeater arrangements for telephone systems." Standard Telephones and Cables, Ltd., and T. R. Gubbins. November 25th, 1929. (343,920.)

36,007. "Signalling devices for railways and the like." H. Bruxby. November 25th, 1929. (344,011.)

36,040. "Control of signalling apparatus by wireless." Pintsch Akt. Ges. December 12th, 1928. (343,924.)

36,063. "Electric discharge devices." Gramophone Co., Ltd., and W. F. Tedham. November 25th, 1929. (343,927.)

36,072. "Photo-electric cells." Naamlooze Vennootschap Philips' Gloeilampentabrieken. May 16th, 1929. (343,930.)

36,263. "Wireless receivers." Gramophone Co., Ltd., and C. E. G. Bailey. November 26th, 1929. (344,017.)

36,323. "Electric switch mechanisms." W. T. Henley's Telegraph Works Co., Ltd., H. S. Wheeler, and E. Moor. November 27th, 1929. (344,020.)

36,329. "Automatic telephone systems." Siemens Bros & Co., Ltd., and C. L. Peters. November 27th, 1929. (343,978.)

36,356. "Operation of railway signals." R. M. Edey and Westinghouse Brake and Saxby Signal Co., Ltd. February 5th, 1929. (343,979.)

36,365. "Electrical transmission systems." Electrical Research Products, Inc. November 27th, 1928. (343,980.)

36,395. "Continuously loaded signalling conductors." Standard Telephones and Cables, Ltd., G. Lawson, and W. H. Dearden. November 27th, 1929. (343,982.)

36,398. "Semi-automatic telephone exchange systems." Standard Telephones and Cables, Ltd., E. P. G. Wright and L. B. Haigh. November 27th, 1929. (343,984.)

36,460. "Synchronous telegraph system." Western Union Telegraph Co. November 5th, 1929. (344,022.)

36,469. "Telephone switchboards." Standard Telephones and Cables, Ltd. (Bell Telephone Manufacturing Co. Soc. Anon.). November 28th, 1929. (344,023.)

36,536. "Wireless receiving systems." J. Robinson. November 29th, 1929. (344,034.)

36,544. "Electric couplings, terminals, or the like." C. R. Cook. November 28th, 1929. (344,035.)

36,602. "Electric motors." R E. Ellis (Adams Sibley Development Corporation). November 29th, 1929. (344,046.)

36,840. "Electric fuses." A. Reyrolle & Co., Ltd., J. Mirrey, and R. W. Biles. December 2nd, 1929. (344,051.)

36,893. "Electric selective multiple-control apparatus more particularly for railway track switches and signals." Westinghouse Brake and Saxby Signal Co., Ltd. December 3rd, 1928. (344,056.)

37,307. "Luminous electric discharge tubes." General Electric Co., Ltd. August 6th, 1929. (Addition to 343,063.) (344,072.)

37,308. "Protective devices for use in telephone or like systems." Standard Telephones and Cables, Ltd. (L. Devaux). December 5th, 1929. (344,073.)

37,310. "Thermionic tube circuits." Standard Telephones and Cables, Ltd., and C. E. Strong. December 5th, 1929. (344,074.)

37,312. "Automatic or semi-automatic telephone exchange systems." Standard Telephones and Cables, Ltd., and E. P. G. Wright. December 5th, 1929. (344,075.)

37,313. "Thermionic valve amplifying systems" Standard Telephones and Cables, Ltd. January 2nd, 1929. (344,076.)

37,372. "Automatic control systems for alternating-current commutator motors." Electrical Research Products, Inc. January 5th, 1929. (344,078.)

37,956. "Electric heaters." Chesterton, Jones & Co., Ltd., and F. F. D. Davidson. December 11th, 1929. (344,089.)

38,013. "Motion picture transmission systems." Kolster Brandes, Ltd. (Federal Telegraph Co.). December 11th, 1929. (344,091.)

38,031. "Lightning arrestors." British Thomson-Houston Co., Ltd. December 27th, 1928. (344,092.)

38,396. "Thermionic valve amplifying and/or detecting systems." A. H. Midgley. December 14th, 1929. (344,096.)

38,785. "Apparatus for delivering electric impulses from a source of current supply." W. Thew. December 18th, 1929. (344,103.)

39,452. "Electrical connecting device." W. T. Henley's Telegraph Works Co., Ltd., and E. Moor. December 24th, 1929. (344,112.)

1930

721. "Electrical translating devices, such as loud-speakers." General Electric Co., Ltd., and D. A. Oliver. January 8th, 1930. (344,130.)

830. "Electric transmission lines." W. W. Triggs (Ohio Brass Co.). January 9th, 1930. (344,132.)

978. "Method of electro-plating aluminium and its alloys." H. Sutton and H. C. Cocks. January 10th, 1930. (344,133.)

1,312. "Electric gramophone pick-ups." Ideal Werke Akt. Ges. für Drahtlose Telephonie. October 29th, 1929. (344,136.)

1,359. "Metering or relay systems." Associated Electrical Industries, Ltd. January 18th, 1929. (344,137.)

1,475. "Method of, and means for, controlling the motors of electric spinning and doubling machines." H. Schneider. January 16th, 1929. (344,141.)

1,582. "Lamp reflectors." Edison Swan Electric Co., Ltd., and H. C. Wheat. January 16th, 1930. (344,143.)

1,668. "Lampholders for electric incandescent lamps." J. A. Kasberg. January 25th, 1929. (344,146.)

2,094. "Protective arrangements for electrical apparatus." General Electric Co., Ltd., and W. Wilson. January 21st, 1930. (344,149.)

2,567. "Electric gramophone pick-ups." Ideal Werke Akt. Ges. für Drahtlose Telephonie. October 29th, 1929. (344,152.)

2,571. "Ignition control in internal-combustion engines." London General Omnibus Co., Ltd., and O. W. J. Watson. January 24th, 1930. (344,153.)

3,135. "Electric power transmission lines." T. J. Kinsey and J. L. Gaved. January 30th, 1930. (344,160)

3,649. "Electric pocket and hand lamps." Elektrotechnische Fabrik Schmidt & Co. Ges. February 8th, 1929. (344,169.)

3,896. "Electric cables." Callender's Cable and Construction Co., Ltd., and H. Hill. February 5th, 1930. (344,172.)

4,230. "Electric voltage indicators." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. February 12th, 1929. (344,175.)

4,252. "Electrically insulating joints." R. E. Ellis (Engineering Products Corporation, Inc.). February 7th, 1930. (344,176.)

4,596. "High-frequency electric transformers for generating high voltages." B. L. Goodlet and Associated Electrical Industries, Ltd. February 11th, 1930. (344,181.)

4,759. "Electric heaters for waving or curling the hair." I. B. Calvete. February 12th, 1930. (344,183.)

5,199. "Electric connectors." Chesterton, Jones & Co., Ltd., and F. F. D. Davidson. February 17th, 1930. (344,189.)

5,222. "Watt-meters." F. W. W. Highfield and Highfield Electrical Co., Ltd. February 17th, 1930. (344,190.)

5,291. "Electrical condensers." Muirhead & Co., Ltd., and A. L. Muirhead. February 17th, 1930. (344,192.)

5,424. "Stranded electric conductors." Pirelli-General Cable Works, Ltd., and J. McLellan. February 18th, 1930. (344,194.)

5,714. "Electric switchgear." International General Electric Co., Inc. February 22nd, 1929. (344,198.)

5,880. "Electrically-driven spinning centrifuges." Maschinenfabrik Oerlikon. March 15th, 1929. (344,200.)

6,236. "Derivation of smooth and uni-directional electric current from an alternating source." R. H. Nunn and F. L. W. Dean. February 25th, 1930. (344,204.)

6,541. "Remote-control systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. February 27th, 1930. (344,212.)

6,554. "Electrical relays." General Railway Signal Co. April 26th, 1929. (344,214.)

7,805. "Thermal switches and circuit controls." A. Choubry. March 12th, 1929. (344,232.)

8,814. "Electric accumulators." Chloride Electrical Storage Co., Ltd., and B. Heap. March 19th, 1930. (344,243.)

9,162. "Adjustment devices for electric induction mechanisms." Soc. Industrielle pour la Fabrication d'Appareils de Mesure. April 9th, 1929. (344,247.)

10,583. "Insulators for sparking plugs." I. G. Farbenindustrie Akt. Ges. April 22nd, 1929. (Addition to 340,865.) (344,256.)

10,598. "Arrangement for automatically influencing trains." Siemens and Halske Akt. Ges. July 4th, 1929. (Addition to 280,230.) (344,258.)

12,029. "Automotive vehicles." W. W. Triggs (Warner Electric Brake Corporation). April 16th, 1930. (344,267.)

12,071. "Electric resistance units." British Thomson-Houston Co., Ltd. April 20th, 1929. (344,268.)

12,594. "High-frequency valve circuits." Telefunken Ges. für Drahtlose Telegraphie. June 1st, 1929. (344,273.)

13,888. "Electric motor controllers providing for selected running speed." Igranic Electric Co., Ltd. (Cutler Hammer Manufacturing Co.). May 6th, 1930. (344,286.)

14,837. "Acoustic diaphragms." L. Lumiere. June 4th, 1929. (344,290.)

15,078. "Manufacture of aluminium by electrolysis" Compagnie de Products Chimiques et Electro-Metallurgiques Alais Froges et Camargue. May 21st, 1929. (344,292.)

16,187. "Galvanometers." British Thomson-Houston Co., Ltd. May 25th, 1929. (344,302.)

17,824. "Turbo-generators." International General Electric Co., Inc. June 10th, 1929. (344,311.)

18,580. "Galleries for electric lamps." J. McLean. June 18th, 1930. (344,313.)

19,058. "Cathode beam oscillographs." Associated Electrical Industries, Ltd. June 22nd, 1929. (344,315.)

19,270. "Transforming alternating current into low-tension direct current." Siemens-Schuckertwerke Akt. Ges. August 1st. 1929. (344,318.)

19,885. "Microphones." M. Marinescu. June 30th, 1930. (Addition to 343,710.) (344,323.)

23,690. "Power installations." British Thomson-Houston Co., Ltd. August 9th, 1929. (344,331.)

24,448. "Sparking plugs." R. Bosch Akt. Ges. December 4th, 1929. (344,332.)

28,832. "Electrically-operated valve-opening and closing apparatus." C. E. Jones. November 26th, 1929. (Cognate application, 39,551/29.) (Divided application on 344,013.) (344,000.)

Trade Mark Applications

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks my be lodged within one month from March 18th :—

S.A.I.V.T. (lettering and design). No. 517,023. Class 8. Electric flexibles and cables.—Societa Anonima Ing. V. Tedeschi & Co., Turin. (British representative: A. J. Andrews, 9, Charterhouse Street, E.C.1.)

Competa. No. 519,553. Class 13. Electric lamps and switches (ordinary), and lugs and clips for use in radio apparatus.—A. F. Bulgin & Co., Ltd., 9-11, Cursitor Street, E.C.4.

Pyrric. No. 520,353. Class 50. Electrical insulating materials.—Metropolitan-Vickers Electrical Co., Ltd., Bush House, Aldwych, W.C.2.

A Gas Protest

Claiming to represent the views of not only the employers of the gas industry, but also those of "113,000 workers directly engaged in the production and supply of gas to nearly 10,000,000 consumers," the National Joint Industrial Council for the Gas Industry has circularised the Press reproducing a resolution recently passed by the Council in the following terms :—"That this Joint Industrial Council desires to enter a most emphatic protest against the carrying on by any Minister of the Crown of propaganda in favour of a particular industry, on the ground that such a course is not only unconstitutional but is most detrimental to other competing industries."

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ALNWICK.—Houses (100); G. Beatty, surveyor.

AUDENSHAW (MANCHESTER).—Houses (106), with electrical work, Springbank estate, for A. Franks.

BEDFORD.—Bakery extension, Midland Road; Bedford Co-operative Society. Premises, High Street, for E. P. Rose and Son, Ltd.

BILLINGHAM (Durham).—Two branch libraries; surveyor to the T.C.

BLACKPOOL.—Alterations, Ansdell Road, for Co-operative Society, Ltd.; Company's architect, head offices, Sheppard Street.

BOURNEMOUTH.—Alterations, London Hotel, Commercial Road; Brickwood, Ltd. Shops and flats, Curzon Road; C. V. Miller.

BRENTFORD (Middlesex).—Houses (191) and flats, Great West Road, for the U.D.C.; E. Willis.

BURY (Lancs).—Switchhouse, control room, and offices, Chamber Hall power station, for the T.C.; borough engineer.

CAERPHILLY (Glamorgan).—Houses (50) for the U.D.C.; surveyor.

CAMBUSLANG, N.B.—R.C. school; rector of St. Brides.

CARLISLE.—Bazaar premises, English Street, for Marks and Spencer, Ltd., London.

CHESHIRE.—Alterations to Chester Road Council School, New Ferry; F. A. Browne, county architect, The Castle.

CONGLETON (CHESHIRE).—Senior school, Waggs Road, for the borough E.C.; director of education.

COULSDON (SURREY).—Houses (50), Coulsdon estate; A. G. Cresswell.

DARLINGTON.—Grammar school extensions for the T.C.; borough surveyor.

DURHAM.—Schools, Billingham, Murton, Hurworth, Shotton, Seaton, Houghton-le-Spring, Haswell, Consett, and Birtley; F. Willey, architect, 34, Old Elvet.

ESTON (Yorks.).—Houses (340), Grangetown Village estate, U.D.C. surveyor.

FAIRHAVEN (Lancs.).—Bank, Cartmell Road, for the District Bank, Ltd., 15, Spring Gardens, Manchester; F. Jones and H. A. Dalrymple, architects, 178, Oxford Road, Manchester.

GLAMORGAN.—School, Tonyrefail, for the county E.C.; clerk, County Hall, Cardiff.

GLASGOW.—Houses (726) for Corporation; city architect. Houses, Carntyne (1,400) and Maryhill (126); housing director and trade contractors. Development Cowdenhill estate; John Lawrence (Glasgow), Ltd. Employment exchange, Govan; architect, H.M. Office of Works, 122, George Street, Edinburgh. Extensions, Parkhead omnibus depôt (£10,000); city engineer.

HAMPSHIRE.—Extensions, Park Prewett Mental Hospital; Joint Committee.

HEMEL HEMPSTEAD.—Houses (110) for the T.C.; borough surveyor.

HIGHWORTH (Wiltshire).—Houses (150) during the next five years for the R.D.C.; surveyor.

IRISH FREE STATE (Dundalk, Co. Louth).—Heating installation at County Infirmary; V. J. O'Connell, architect, Earl Street. (Passage West, Co. Cork).—Alterations to residence of Capt. Lindsay at Rockenham; Chillingworth & Levie, architects, 11, South Mall, Cork.

KINGSTON-ON-THAMES.—Bazaar premises, Sun Hotel site, for F. W. Woolworth & Co., Ltd., Kingsway, W.C.

KNUTSFORD.—Cinema (£22,000) for the Cranford Cinema, Ltd.; C. Swain & Partners, architects, King Street, Manchester.

LEAMINGTON SPA.—New block at general hospital, Radford Road; C. M. Armstrong, architect, 39, High Street, Warwick.

LIVERPOOL.—Hotel, Prescot Road, Stanley; H. Davies and Sons, architects, Wellington Buildings, The Strand.

LONDON (Ilford, E.).—Town hall extensions (£73,316) for the T.C.; E. A. Russell, Ltd., builders, Boundary Road, Walthamstow, E. (E.C.).—Buildings, Abchurch and Sherborne Lane, for Phœnix Assurance Co., Ltd.; Campbell Jones, Sons and Smithers. (Stoke Newington, N.).—Buildings, Shelford Place; A. J. King, Ltd. (Fulham, S.W.).—Flats (110), and shops, Parkview Ct., for Western Heritable Investment Co., Ltd.; J. A. Mactaggart. Alterations and additions, Albert Yard; W. J. Marston & Son. Premises, Stevenage Road; Redline Motor Spirit Co., Ltd. (Chiswick, W.).—Christian Science Church; Davidson, Son & Sherwood, architects, 14, Rectory Drive, Gosforth, Newcastle-on-Tyne. (Ealing, W.).—Houses (68); Great Western Land Co., Hanwell, W. (Clapham, S.W.).—Baths, Manor Road (£64,000); C. Miskin and Sons, Ltd. (Tooting, S.W.).—Cinema, Upper Tooting Road; H. S. Scott, architect.

MANSFIELD.—Library extensions for the T.C.; borough engineer.

MIDDLESBROUGH.—Extensions to sanatorium (£40,000); borough engineer.

NANTWICH (Cheshire).—Water supply scheme (£135,000), surveyor to the R.D.C.

NEWCASTLE-ON-TYNE.—Joint Methodist Church, Cowgate; trustees, second P.M. Circuit. Reconstruction of stores for H. Binns, Son & Co., Ltd. Branch premises for the Co-operative Wholesale Society, St. Anthony's; contractors, C.W.S. Building Dept., Newcastle. Soap works extensions, for Thomas Hedley & Co., Ltd.; W. T. Calderwood, managing director. Congregational church; Marshal & Tweedy, architects, Mervyn House, Pilgrim Street.

NEWPORT (Mon.).—Nurses' hostel, Royal Gwent Hospital, Caerphilly (£43,250); R. Jones.

NORTHAMPTON.—Extensions, Daventry Institution (£11,440), for the Public Assistance Committee; clerk, Northampton.

NOTTINGHAM.—Schools, Annesley Woodhouse, Beeston, and Sutton-in-Ashfield; for the county E.C. School, Sneinton Vale; St. Patrick's Catholic trustees.

OLDBURY.—Hotel, Warley, for Mitchells & Butlers, Ltd., architect, Birmingham; S. Wood.

OLDHAM.—Alterations, &c., Church of England schools; F. Thorpe, architect, Union Bank Chambers, Church Lane.

PAISLEY.—Hospital for infectious diseases; burgh architect.

PENRITH.—Offices, depôt; Russian Oil Products, Ltd. Waterworks (£28,500); R.D.C. surveyor.

PETERBOROUGH.—Houses (100) for the T.C.; borough surveyor.

PRESTON.—Houses (56), Deepdale; borough engineer.

PRINCES RISBOROUGH (Bucks.).—Post office for H.M. Office of Works, King Charles Street, London, S.W.

RAMSGATE.—Wesleyan church, Northwood; J. B. Sharman, builder.

READING.—Houses (236), Southcote Lane estate, for R. J. Haddock, Ltd.

REDCAR (Yorks.).—Hotel (£13,000); S. H. Clarke, architect, 89, Grange Road, Middlesbrough.

SALFORD (Lancs.).—Extensions, Royal Hospital, Chapel Street; architects, P. Barmer, 32, King Street West, Manchester, and Dr. P. S. Worthington.

SEAHAM HARBOUR (Durham).—Houses (104), Carr House estate; U.D.C. surveyor.

SHEFFIELD.—Ice rink for London and Provincial Ice Rink, Ltd.; Elcock & Sutcliffe, architects, Strand, London, W.C.2. Wesleyan chapel, Bents Green; W. Marlowe & Son, Ltd., builders, Hillsborough. Secondary school, High Storrs; W. G. Davies, city architect.

SOUTHAMPTON.—Wesleyan hall, Burgess Road, Swaythling; H. Calling, architect.

SOUTH ELMSALL (Yorks.).—School, Upton Colliery Company's estate, Harewood, for the E.C.

SOUTH SHIELDS.—Houses (68), Stanley Terrace, &c.; borough engineer. Secondary schools, for the E.C.

STIRLING.—Reconstruction of business premises, corner of Port Street and Dumbarton Road, for Graham & Morton, Ltd.

STOCKTON-ON-TEES.—Municipal buildings (£44,000) and baths (£47,000); borough engineer.

STOKE-ON-TRENT.—Houses (4,000), during the next five years; city engineer.

STRANRAER.—Cinema (£12,500); J. McKissack, architect, 68, West Regent Street, Glasgow.

STRATFORD-ON-AVON.—Extensions. Royal Label Factory, College Lane, for Ball Bros.; H. W. Carter, architect. Conversion of Welcombe House into country hotel, with extensions, for the London, Midland & Scottish Railway Co.; W. H. Hamlyn, architect, Euston Station.

SURBITON (Surrey).—Central school, Tolworth (£34,285); G. Parker & Sons.

SURREY.—School (384 places), Ridge Road, Sutton, for the county E.C.

SWANSEA.—Additions, St. Gabriel's Church, Bryn Road; vicar. Remodelling, Plasmarl School; borough architect.

TOTNES.—Premises (£20,000), High Street, for James Palmer.

TWICKENHAM.—Houses (82), Tranmere and Constance Roads, Hamilton and Mayfair Avenues; the Heathcote Estate, Whitton.

WARRINGTON.—School, Latchford (250 places), for the R.C. managers; Rev. Father J. L. Cullen, St. Augustine's.

WEST BROMWICH.—Extensions, General Hospital (£20,000); secretary.

WEST RIDING.—Schools (£16,000), Baildon, Crofton, Earby, and Ilkley (£28,000), for the county E.C.

WEST SUSSEX.—School extensions, Lancing, and Collyer's Grammar School, Horsham; H. P. Roberts, county architect, Chichester.

WIGAN.—Baths and washhouses (£31,000); borough engineer.

WINCHESTER.—Houses (60) for the T.C.; city surveyor.

WOODSTOCK (Oxford).—Development of Gosford Hill estate for residences, &c.; Gardner & Dodd, architects, 7, St. Aldates, Oxford.

YEOVIL.—Post office, King George Street, for H.M. Office of Works, King Charles Street, London, S.W. Factory extensions, for Aplin & Barrett, Western Counties Creameries.